Railway and Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

INDEX FOR VOLUME XIII, 1900.

Illustrated articles are marked with an asterisk (*).

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII 95 Liberty Street, New York, January, 1900 No. 1

Heavy Consolidation Engine for Illinois Central.

We illustrate by half-tone and line engravings an extremely heavy and powerful locomotive recently built at the Rogers Locomotive Works, Paterson, N. J., for the Illinois Central Railroad, to be used on one of the divisions south of the Ohio river, where the grades are somewhat heavier than on the divisions connecting with it.

The engine is intended to haul trains of a maximum weight of 2,000 tons over grades of 38 feet to the mile. This will be easily within the capacity of the engine, which has a traction power of about 50,000 pounds. The grade of 38 feet to the mile will call for 14.44 pounds to overcome the gravity, as the number of feet rise to the mile multiplied by 0.38 gives the resistance due to gravity. Then there is about 6 pounds per ton for ordinary train resistance, and we will allow 0.56 per ton for curves. This aggregates 21 pounds per ton of train resistance. When the traction power is divided by this it tells that the engine ought to haul 2,400 tons, which includes the weight of engine and tender.

The engine has cylinders 23 x 30 inches, and the driving wheels are 57 inches outside diameter. The boiler carries a working pressure of 210 pounds to the square inch. The total weight of the engine is 218,000 pounds, of which 198,000 pounds rest upon the drivers. This is not a case of piling on weight to make a heavy engine. All over the engine displays indications of careful designing, and all the working parts have been made as light as possible consistent with the tremendously heavy work that has to be performed. The driving wheel base is 16 feet 3 inches, and the total 34 feet 5 inches. The driving axles are of nickel steel, and have journals 9 x 13 inches. The truck axle has journals 6 x 10 inches.

As will be noticed by the engravings, the boiler is of the Belpaire type and is 80 inches diameter at the smokebox end. The firebox is 132 inches long (11 feet), 42 inches wide, and is from 78 to 75 inches deep. There are 417 2-inch tubes 13 feet 6 inches long. The firebox provides 252 square feet of heating surface, and the tubes 2,951 square feet, making a total of 3,203 square feet. There is 38.5 feet of grate area. As has already been mentioned, the working pressure is 210 pounds to the square inch.

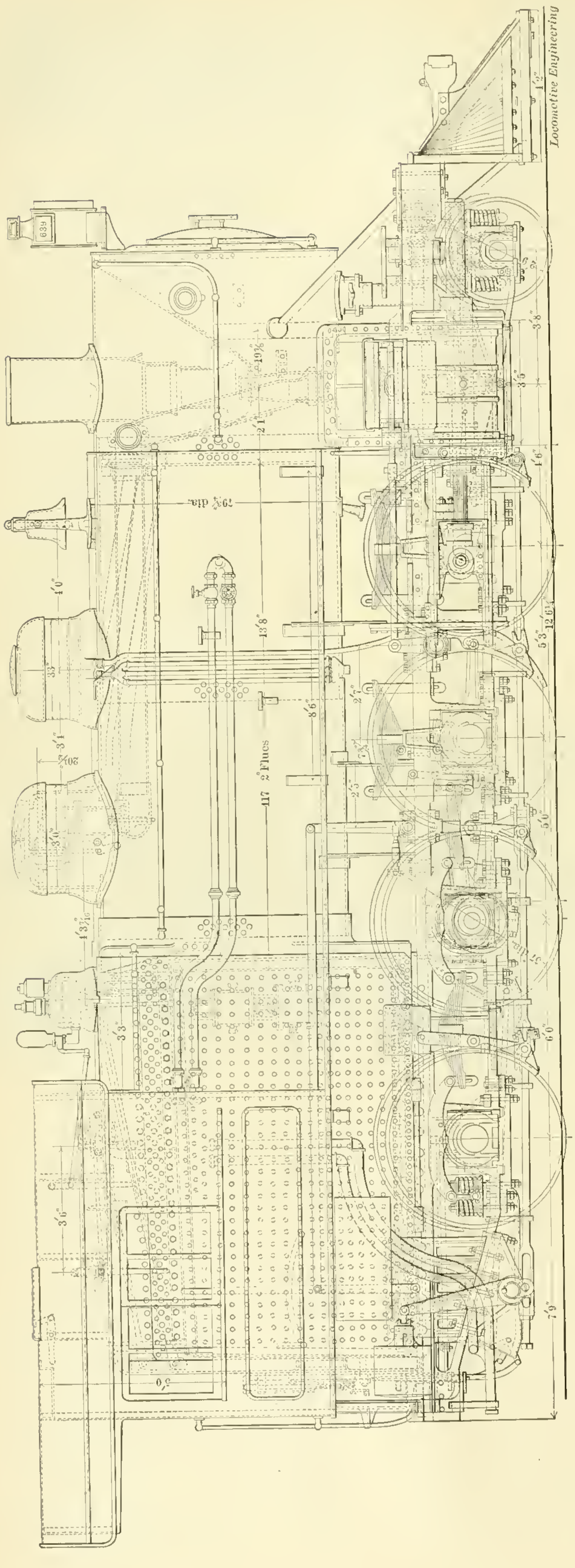
There is a heavy steel casting secured back of the cylinders, extending 59½ inches between the frames, and strongly bolted to cylinder and frames. This is intended to support the frames at that place, securing them to the cylinder casting in a most substantial manner. This will relieve the cylinder saddle to a great extent of the twisting action which throws severe strains upon the frames and saddle of engines of this character.

The engine has remarkably liberal bearing surfaces throughout. The cross-head is of the alligator type, which is coming rapidly into favor because it holds the piston rod central and seldom causes breakage. The guides are 9½ inches wide, of wrought iron, case hardened. The piston rods are of nickel steel, 4½ inches diameter, and are extended through the front cylinder cover. The pistons are steel, with cast iron packing. The slide valves are American balanced, with 6 inches maximum travel. Long ports are employed, and the admission and exhaust passages are large, the former being 1⅝ inches, the exhaust 3½ inches, the length in both cases being 23 inches. The bridges are 1⅝ inches wide. There are some peculiarities about the links and the way they are hung. The link is 3⅛ inches wide, and is supported on both sides by a horseshoe-shaped hanger, the saddle being in two parts, bolted to the back half of the link. The forward half has a rib on its front face to give it stiffness.

HUGE ROGERS CONSOLIDATION FOR ILLINOIS CENTRAL, BUILT BY ROGERS LOCOMOTIVE COMPANY, PATERSON, N. J., MR. W. RENSHAW SUPERINTENDENT OF MACHINERY.

Mr. Reuben Wells, general manager of the Rogers Locomotive Works, from whom we received the detailed particulars from which this description is being written, devoted considerable work and ingenuity to finding out the center of gravity of the engine, a line of investigation which appears to have received but little attention since the modern high engine made its way into favor.

The center of the boiler is 9 feet 2 inches above the top of the rail, and the



ROGERS HEAVY CONSOLIDATION ENGINE FOR THE ILLINOIS CENTRAL.

top of the boiler at the base of the dome 12 feet 6 inches, and the top of the stack, sandbox and dome casing are all practically 15 feet. The crown sheet of the firebox is 10 feet 6 inches above the rail at the flue sheet.

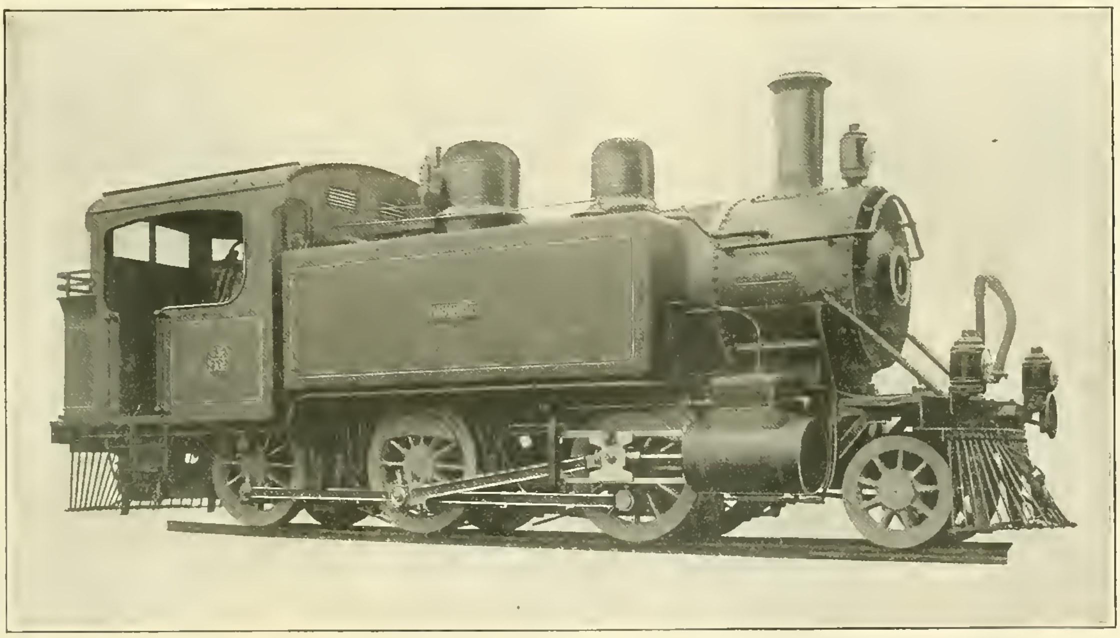
As not much seems to be known as to how high above the rails the center of gravity of locomotives having their boilers unusually high, such as this one, may be expected to be found, taking the whole engine in working order as one mass, a test was made of this engine to determine its center of gravity by suspending it on the upper surface of two 3-inch steel pins or journals for pivots, the one at the front being located 6 inches in front of the cylinder saddle and the back one 6 inches back of the back end of the boiler, and both the same distance above the rails and on the vertical center line of the engine. The engine when suspended was complete, with all its parts in place and the boiler filled with cold water to the second gage, the drivers and truck wheels all clearing the rails about 2 inches. The engine was as near as practicable in the same condition and of the same weight as it would be in working order. As mentioned, the steel suspension pins were 3 inches in diameter; they were supported at both ends, and the bearing surface resting on them was horizontal so as to reduce friction at the bearing point to a minimum. On trial, the bearing points as first located proved to be considerably too high. They were lowered and tested again several times, until the engine balanced on the pivots. Screws were used at the ends of the bumper for testing and to keep the "roll" to either side, within limits when the pivots had been lowered to the point of the center of gravity. At that point a lift of about 300 pounds under the end of the bumper was sufficient to cause the engine to turn in the opposite direction to the extent that the bumper at that end was about 8 inches higher than the opposite end. On removing the lifting force the engine would not, of itself, return more than half way back to the vertical position, but required a lift of about 100 pounds at the low side to bring it vertical, about enough to overcome the pivot friction, but when vertical and free it would remain so. It required about 100 pounds, however, to start it to turn in either direction. The tests show that the point of suspension was probably as near the actual center of gravity of the engine as it was practicable to locate it. After the adjustments were all made and the center of gravity point found, measurements showed the bearing point on top of the steel pin at each end of the engine on which it rested to be 50½ inches above the top of the rails as the engine would be when the drivers are resting on the track. That point is 3¾ inches above the top of the main frames. Assuming the bearing point of the drivers on the rails to be 56 inches apart, then the base on which the engine runs is 1.10 times as wide as the distance its center of gravity point is in height above them. Without positive knowledge to the contrary, most persons, we think, judging from appearances only, would conclude that the center of gravity of a locomotive like this must be considerably above the point given, yet the tests show conclusively that it is not.

If the center of gravity point of a locomotive like this is 10 per cent. less in height than the base on which it is carried is wide, it is probable that the center of gravity could be carried still slightly higher without any detrimental results of consequence as regards the movement of the locomotive along the track.

Among the equipment specified for the engine are Coffin toughened steel crank pins, Hancock injectors, Leach sanding device, Detroit lubricators with Tippet attachment, three Ashton safety valves, United States metallic packing, Krupp crucible tires, French springs, Westinghouse-American brake, Fox pressed steel trucks and Monarch brake beam.

Dickson Engines for South Africa.

The locomotive here illustrated is one of a group recently built at the Dickson Locomotive Works for South Africa. The engines are for the Dundee-Vryheid Railway. Cylinders, 14 x 20; drivers, 44 inches; fuel, bituminous coal; total wheel-base, 19 feet; driving wheel-base, 12 feet 6 inches. The boiler is of the straight-top type, 48 inches diameter at smokebox end. The firebox is 6 feet long and 30 inches wide. One dome, 24 inches diameter. The boiler is radial stay type, containing 168 1¾ inches diameter No. 13 gage iron tubes, 9 feet 6½ inches long. Total weight of engine, about 73,000 pounds. Weight on drivers, about 62,000 pounds. Tank capacity, 1,000 gallons; coal, 3,300 pounds. Truck wheels, 30 inches diameter. Brakes, automatic vacuum. Working pressure, 180 pounds.



DICKSON TANK ENGINE FOR SOUTH AFRICA.

Automobiles in Chicago.

Automobiles have invaded Chicago in great force. Numbers of them are now seen on the streets, both public and private conveyances.

One of the railroad magnates who took a ride down State street in one of the hansom cabs, said that it reminded him of a ride on the front end of a four-wheel pony switch engine as it teetered up and down on the rough pavement and dodged here and there to get by other vehicles. One of the latest styles is said to have the motors in the wheel hubs, where they are out of sight.

They have come to stay. When competition has reduced their price in the same proportion as the price of bicycles has been reduced in the last five years, the horse will have a rival among people of moderate means. Just now the price is almost prohibitive.

Foundations for Shops Floors.

The foundation for shop floors—the ground floor, of course—is an important item and open to many modifications.

The General Electric Company at Schenectady have adopted a somewhat novel plan in their new machine shop, and use first a broken stone foundation. On this they use cinders which have been dipped in tar, but do not pour the tar over them, as this makes them almost a solid mass and hard to remove in case it is necessary to put in a new foundation or for other cause. The floor timbers are bedded in this, and it is said to preserve them in good shape. On these are nailed the 2-inch plank, and crosswise on these 1-inch maple. It seems almost wicked to put down fine maple boards for shop flooring, but it pays and can be readily renewed.

Some shops put down a concrete or broken stone foundation and lay the planks directly on this, nailing the floor boards at right angles to these.

Still others put the floor timbers on top of the concrete, rather than in it, and proceed as before, and, of course, many use a solid concrete floor without further covering.

Under the caption "Foot-plate Heroism," *The Engineer* says: "The recent mishap at Coupar Angus, in the North of Scotland, when a passenger express (while running at over sixty miles an hour along the thirty-mile course, on which is daily enacted the quickest British run) collided with a cattle train, illustrates once more that we have heroes—and modest ones—at home as well as abroad. The goods-engine was overturned, and, on the rescue party reaching the imprisoned enginemen, the stoker—with one leg broken and head considerably injured—refused immediate assistance, saying, 'I'm not so bad, lads; look to my mate first.' His mate, the driver, was, however, too seriously hurt to survive."

Two rustic Irishmen who had seen little of city life were walking to Dublin one day. Going through the fields, they suddenly came upon an automobile bowling along the main road. Both looked at the apparition in astonishment. Catching his breath, one shouted: "By gorra, Mike, it's a carriage run away from the horse. Let's run and catch it."

Odd Types of Railroad Men.

BY J. H. GOODYEAR.

ILLUSTRATED BY R. SORANSON.

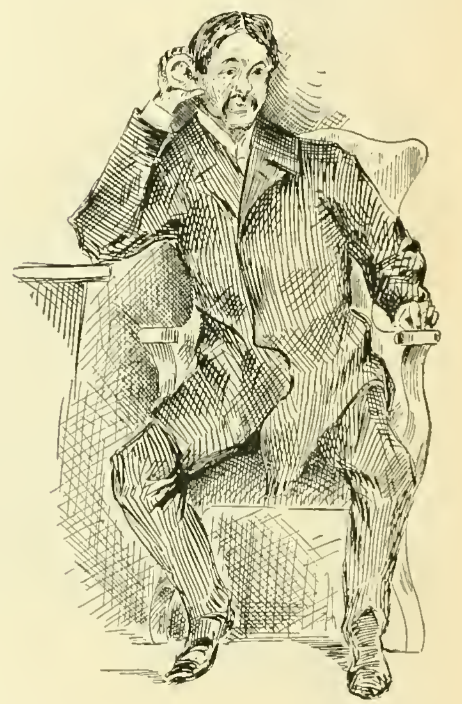
That it takes all kinds of people to make a world and that this is particularly true in regard to the railway world, is shown by a description of a few types of men we have met during our railway career.

Who is not familiar with that very common type of young ticket clerk, who, when asked by an old lady the fare to Mud Creek Junction, answers in a brusque manner, two dollars sixty-five, and immediately turns on his heel, leaving the old lady patiently waiting while he discusses with a fellow clerk the merits of the play they attended the previous evening. Notice the same young man when a pretty girl asks him a question. In his effort to make an impression he will caper about and chatter nonsense until his actions strongly remind one of a monkey attached to a street organ.

THE OLD LADY PATIENTLY WAITING.

WHEN A PRETTY GIRL ASKS HIM A QUESTION.

To active members of railway clubs our next type will be familiar. From its inception he has been a regular attendant at the club meetings. Occupying, as he does, a position necessitating a knowledge of most of the subjects usually discussed, one would think he would take an active part in the discussions of the club, yet when called upon for his views he invariably replies, "I am not prepared to talk on the subject this evening, Mr. President." He has for years been listening so intently that one of his ears has become elongated to such an extent that he is beginning to resemble a donkey.



ONE OF HIS EARS HAS BECOME ELONGATED.

To offset our silent member, we have the university professor. This gentleman is usually accompanied by several students and seldom allows an opportunity pass by to say something. His remarks are usually prefaced by "If I remember rightly, Mr. President, our practice on the Great Southern system was," etc., etc., proceeding to enlighten the members as to methods in vogue many years ago.

Railroad men, as a rule, hate a liar worse than they do a debt collector; but our next type is such a graceful and cheerful liar that we have decided to sink prejudice and describe him.

He holds a fairly responsible position, his duties consisting principally of exercising a general supervision over all classes of operating employés. He is required to render to his superior officer a weekly report, covering briefly the ground covered during the week. In his eagerness to make a good showing he will report incidents taking place at stations at a certain time and date, to have it proved that he passed through the stations in question on a passenger train moving at the rate of fifty miles an hour. Seventy-five per cent. of the cases reported by him, when investigated, are proved to be founded on hearsay. Still he goes on his way, cheerfully lying about his fellow workmen until he has become so used to it that he does not know whether he is lying or lyingly telling the truth.

In these days of experiments and pulls, railway officials are taken from all walks of life. Sometimes they have experience; when not experienced they usually—to offset their lack of it—have strongly developed ideas of their own in regard to running a railroad. We met an official years ago who firmly believed there were but three things necessary to successfully operate a railroad. These were centralization, executive ability and bluff. At that time we were young and unsophisticated, and firmly believed that a knowledge of the science of railroading was necessary to success. Now, after many years, standing, as we do, at the foot of the ladder, gazing at our friend on the top rung, we feel inclined to agree with him, particularly if he will make the three necessary things four, and name the fourth "pull."

Our next type is one that is gradually becoming extinct. He is illiterate, conceited and pompous. It is said there are moments in life when language fails a man. This is not the case with our friend. He is never silent for the want of something to say, and nothing delights him more than to talk to and give advice to the boys. This he takes every opportunity of doing, usually concluding with the remark, "I got there by sheer hard work and merit." The boys wonder where the merit came in, but would not if they knew how our friend really got there.

Then we have the conscientious, hard-working traveling foreman. Travel and appearing to hustle are as necessary to him as food. He will send written instructions by train, and travel 500 miles on the same train in order to give the instructions in person. He covers a lot of ground, but accomplishes very little. One of his peculiarities is to wire his men along the line that he is on a certain train and wishes on his arrival to see them. In the dead of the night he may be seen interviewing from a sleeping-car berth men who have waited up half the night to meet him. The interview usually consists of, "Everything all right, Tom?"

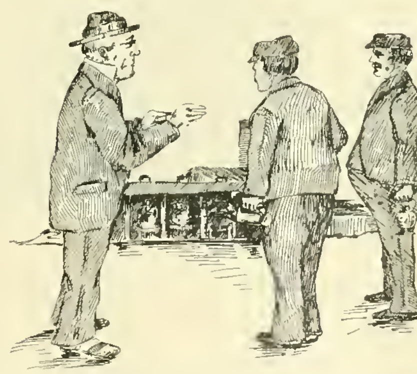
Our next is a downright practical man. He is a master mechanic of the type of twenty-five years ago, when the principal qualifications for success were good workmanship and sobriety. To him a technical man is as a red flag to a mad bull. "It makes me tired, sir," he will exclaim, "to hear them calling a man down for not being able to do that which they cannot themselves do. Can they set valves or run an engine? No, sir; but they have the nerve to tell other men how it should be done."

"IF I REMEMBER RIGHTLY, MR. PRESIDENT."

It has of late become the correct thing for university graduates who have taken the civil engineering course to work on the section in order to gain practical experience in track work. McCarthy, a section foreman, not long ago had a student assigned to his section. About a week after the student's appearance McCarthy was heard holding forth to the machine shop foreman somewhat in the following strain: "Phwat's that yez say? Yez have wan of thim college bhoys wurking for yez? Begorra, and it's mesilf that has wan av thim same bhoys, and a divil for larnin' he is sure. Says he to me th' outher marnin, 'Mister McCarthy,' says he, 'whin yez next ordther shovels phy not ordther thim two sizes larger, for,' says he, 'the bhoys will pick up more dirt with a larger shovel.' And thinks I, McCarthy, sure it's yezself that's been wurking on the saction fur tin years and niver wance tho't of the loike. An' they tell me, Moike, that the same bhoy writes the edgitorials in the 'Thrackmans' Goide to the Road Master's Job.' "

Our next and, for the present, last is the "Pedantic Official." If his position entails outdoor supervision he finds plenty of work for his peculiar abilities. He will be found on the platform of the rear coach, gazing intently at nothing, occasionally removing his gaze a sufficient length of time to scribble a note, which, later on, is seen fluttering in the wind towards a workman. He takes every opportunity to engage in conversation with the traveling public in order to show his knowledge of things in general and railroading in particular. In his trips over the road he naturally comes in contact with all classes of employés. From these he gleans all he can, and soon becomes possessed of a superficial knowledge of what other officials are doing. He shines most, however, when the managing official makes a trip over the road. Our friend on these occasions "does himself proud." Standing on the platform of the rear coach with the "power that be," he may be seen struggling, by the aid of a superfluity of words, to make the most of a scarcity of ideas.

"I GOT THERE BY SHEER HARD WORK AND MERIT."



"CAN THEY SET VALVES OR RUN AN ENGINE?"

Proposed Legal Deadheading on a Large Scale.

Senator Chandler has introduced a bill in the Senate at Washington which he intimates is for the purpose of increasing the efficiency of military and naval graduates. To us the measure reads like a huge joke. He proposes to amend the educational course at West Point and Annapolis to dispense with the study of languages and of higher mathematics and substitute therefor courses in athletics, to embrace especially golf, bicycling, baseball and football. He further proposes that contests in athletic sports shall be held annually in Boston, New York, Philadelphia, Pittsburgh, Cincinnati, St. Louis, San Francisco and a number of other towns. About the funniest part of the bill is Section 4, which reads:

"The various railroads subject to the Interstate Commerce act of February 4, 1899, and the amendments thereof, may and shall carry free to and from the aforesaid national contests all cadets and instructors at the two academies, all officers, civil or military, on duty at the two departments; all correspondents of reputable newspapers, and such other persons as may be designated by said secretaries or as said railroads may choose to carry free; and the section of said act making discriminations criminal, and especially Section 22, are hereby modified and amended so as to make lawful the free transportation authorized or required."

"SAYS HE TO ME TH' OUTHER MARNIN': 'MR. M'CARTHY,' SAYS HE."

Kansas and Nebraska farmers are complaining bitterly because the railroad companies cannot furnish promptly the large number of cars necessary to move the immense corn crop just harvested in those States. As the politicians in those States have been doing their level best for the last ten years to ruin or impoverish railroads, their constituencies had better blame them for part of the scarcity of cars.

A Rough Comparison of Simple and Compound Engines.

In looking over a table showing comparative sizes of cylinders of simple engines and compounds, we found a rough way of estimating the power of one as compared with the other. Taking 180 pounds of steam on each, we find an 18-inch engine rated equal to a Vauclain compound having 13-inch high-pressure cylinders and 22-inch low-pressure. Adding 13 and 22 we have 35, which comes within one of being twice the diameter of simple engine.

Double the diameter of the simple engine's cylinder then, equals the added or combined diameters of high and low, and three-fourths of the simple cylinder equals high pressure of compound. This seems to be borne out fairly well, all through the table, and near enough for a rough estimate off-hand.

Taking same pressure, what is a Baldwin compound with cylinders 9 and 15 inches? What simple engine can it be compared with? Adding 9 and 15 we have 24. Divide by 2 and we get 12 inches, which agrees with table.

Again, what compound of this type is equivalent to a simple engine having a 17-inch cylinder? Twice 17 equals 34, or combined diameters of compound cylinders. Three-quarters of 17 is 12¾, which would leave 34 — 12¾, or 21¼ inches. In reality, the table gives 12 and 20. Not very close, to be sure; but this gives a guessing point at least, and most cases come nearer than this.

In the case of two-cylinder compounds a rough calculation can be made by assuming the high-pressure cylinder to be 10 per cent. larger than the cylinder of a simple engine, and make the low-pressure cylinder one and one-half times this. This gives a ratio of 2¼ to 1, which is an average for two-cylinder compounds. This, for a two-cylinder compound equal to a 20-inch simple, would give a high-pressure cylinder of 22 inches and a low of 33 inches, which would not be very far off.

In comparing a compound to a simple, divide the high-pressure cylinder by 11 and multiply by 10, which gives the diameter of simple cylinder of approximately equal power. These are not recommended for anything except rough estimating—off-hand—to get some idea of comparison without figuring, and simply give a guide to guessing somewhere near the right dimensions.

Effect of Cars Resting on Side Bearings

Mr. J. W. Thomas, general manager of the Nashville, Chattanooga & St. Louis Railway, is now making a series of tests to determine the exact amount of extra power required to draw a loaded car when the weight is carried partly on the side bearings instead of being all on the center bearing. He picked out a train of loaded cars with more or less of the weight on the side bearings and tested this train on a grade with curves leading both ways. He then had all these cars raised on the centers till they were free on the sides and tried them again on the same piece of track, under the same conditions of rail and speed. The variation of resistance before and after raising the cars was something remarkable. Of course, it varied with the different cars.

Another test is to be made shortly on very crooked track. The results in full will then be furnished the readers of Locomotive Engineering.

A Crossing Wreck.

The wreck here illustrated by two views happened at a railroad crossing in North Carolina. One engine hauling a train was on the crossing when another with a train

A CROSSING WRECK.

behind it came along without stopping and struck the engine that was on the crossing just behind the cylinders and knocked it 56 feet down the track and stopped in the position shown in the picture. No one was fatally injured.

Reducing Needless Expense.

Among the changes noted on various railroads is the decreasing use of brass and a corresponding increase of cheaper metal. At the prevailing price for brass to-day this amounts to considerable on a locomotive.

The New York Central and other roads are doing away with brass trimmings, such as oil cups, and substituting malleable iron with good results. The iron is not hard to work, is cheap, and has the additional advantage of presenting no temptation to petty thieving around yards, which is quite an item on a large road. We understand that the saving due to this change amounts to about $90 on an average engine.

Hard on Engineering Text Books.

Dr. Alexander Barr, professor of civil engineering and mechanics in the University of Glasgow, has a very mean opinion of the knowledge contained in engineering text books. In the course of an address delivered before the Institute of Civil Engineers he said:

"There is nothing I desire so much to impress upon you as the wisdom of having a profound distrust of formulas. You cannot safely use a single formula in Molesworth that has to do with a question of mechanical science, unless you know what is behind the symbols. Every formula must be based on a host of assumptions, and it is only one who knows how a particular formula is derived that can be trusted to apply it.

"Let us take an illustration. I suppose that the formula $b = \frac{P}{a}$, expressing the stress per unit area in a bar subjected to tension, is about as simple a one as could be chosen. I do not know any case in which that formula is strictly true for a member of a structure as a whole, but I do know many cases in which it is not even approximately true."

Then he proceeded to prove the truth of his contention, and left nothing for the miserable formula to rest a foot upon.

"Record of Recent Construction, No. 16," from the Baldwin Locomotive Works, is a very interesting issue. Under the head of "American Locomotives for England" it gives a picture of the famous Lickey incline of the Birmingham & Gloucester Railway and of the "Philadelphia," which was one of the four engines Norris sent over, and which came out best on the trials. This was in 1840. They also show some fine specimens of moguls, ten-wheelers and consolidations.

Lehigh Valley Trunk Line.

The Lehigh Valley Railroad has finally met with success in the long drawn-out attempt to secure the right to lay its tracks across Communipaw avenue, Jersey City.

An ordinance permitting the crossing was passed by the Jersey City authorities some time ago, but its operation was held up, owing to an objection from a technical legal standpoint that was raised by its opposers. This legal objection was removed by the State Court of Errors and Appeals, the decision being handed down at 2.15 P. M. on November 20. As soon as the decision was announced the railroad people prepared to get started with the work of laying the tracks, which work was completed, four tracks being laid, by 12 o'clock midnight the same day. The street was cleared of all obstructions at 12.40 A. M., and the first train passed over the crossing at 12.50 A. M. A force of about 250 men was employed in doing the work.

Pittsburgh Twelve Wheeler for the Chicago & Eastern Illinois.

Our illustration shows one of a group of twelve-wheel engines recently built by the Pittsburgh Locomotive Works for the Chicago & Eastern Illinois. Why these were made twelve-wheelers instead of consolidations or moguls we do not understand, but it has probably been with the view of extending the wheel-base to distribute the weight as far as possible over light track or weak bridges. In working order the engine weighs 173,700 pounds, of which 143,000 pounds are on the drivers. The rigid wheel-base is 15 feet 6 inches, and the total engine wheel-base is 25 feet 4 inches. The cylinders are 21 x 26 inches, and the driving wheels are 54 inches in diameter. The following are a few of the leading particulars about the engine:

Height from rail to top of stack—14 feet 10 inches.

Cylinders, diameter and stroke—21 x 26 inches.

Piston rods—Cambria steel, 4 inches diameter.

Type of boiler—Extended wagon top.

Diameter of boiler at smallest ring—64 inches.

Diameter of boiler at back head—72 inches.

Crown-sheet—Supported by radial stays, 1⅛ inches diameter.

Staybolts—1 inch diameter, spaced 4 inches centers.

Number of tubes—296.

Diameter of tubes—2 inches.

Length of tubes over tube-sheet—13 feet 6 inches.

Length of firebox, inside—126 inches.

Width of firebox, inside—41 inches.

Brick arch, supported on studs.

Working pressure—200 pounds.

Grate surface—36 square feet.

Heating surface in tubes—2,081 square feet.

Heating surface in firebox—192 square feet.

Total heating surface—2,273 square feet.

Diameter of driving wheels, outside of tires—54 inches.

Diameter and length of journals—8½ x 10 inches.

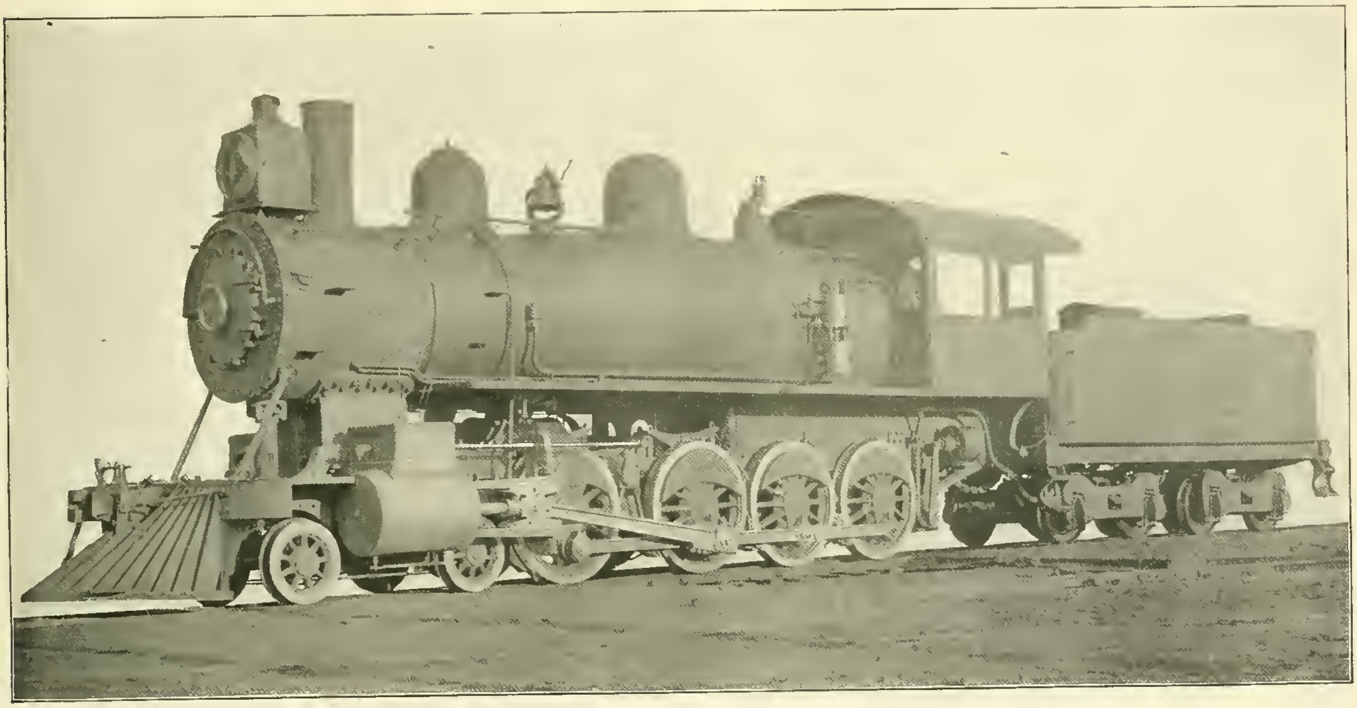
Diameter of truck wheels—28 inches.

Diameter and length of journals—5 x 10 inches.

Water capacity of tender—4,500 United States gallons.

Fuel capacity—320 cubic feet.

Type of brakes—Westinghouse American.



PITTSBURGH LOCOMOTIVE FOR CHICAGO & EASTERN ILLINOIS, T. A. LAWES, SUPT. MOTIVE POWER AND MACHINERY, PITTSBURGH LOCOMOTIVE WORKS, PITTSBURGH, PA.

A speaker at a meeting of railroad officials held in Boston last month urged that it was necessary to use greater care in the physical examination of applicants for positions in railroad service. He directed attention to the large percentage of applicants excluded from the army, navy and Government civil service on account of unsatisfactory physical conditions, yet people who had been rejected by the Government because their health was not satisfactory found no difficulty in entering railroad service, and frequently were taken on to perform the most arduous and exhausting duties. Men of this kind make it hard for those in robust health, especially in bad weather.

Plain Talks to the Boys.

C. B. CONGER.

BREAKING IN NEW ENGINES.

Having trouble with your new engines, you say? Well, that is not a new complaint; for a great many new locomotives have been put in service this summer. These engines in a great many instances are one and two sizes larger than the ones we have worked with for the last few years, and with the increase in size and weight come some difficulties that are not as easily overcome in "breaking them in" as with the smaller engines. The operating officers recognize this fact, and one of the high compliments they pay the new machines is that they are "breaking in very nicely and do steady work afterward."

It is customary, if the engines run hot or the bearings are found cut in the beginning of their regular service, to blame this to carelessness on the part of someone who "broke her in."

The engine tamer who is acquainted with the troubles of new engines does not break them all in; the extra man gets a chance at it. These remarks are intended for his benefit.

In many cases the messenger who brings the engine up from the builders and has charge of it till tried and accepted, does this work. If two or more engines come at one time he cannot look after all the details.

Some of these locomotives make long trips from the manufactory to their future home and run cool all the way. But on this trip, in a freight train, the speed is not very fast, stops are frequent, the boiler is cold and tender is empty; the machinery is not coupled up, so that every bearing can be got at for inspection and lubrication easily. When they go into service this is different; the boiler is full of water; the heat of the firebox makes the axles near or under it so warm that it does not take much friction to raise the temperature so that oil will smoke and not lubricate.

There are a number of precautions which can be taken when putting the engine together and handling it during the breaking-in process that will help to put it in the best shape for doing good work afterward.

While the locomotive builder takes pride in making all the pins and bearings a snug fit, so that when at work after breaking in there will be a minimum of lost motion, yet the line between a snug fit for service and a tight fit to allow for the wear that smooths them up is sometimes a close one.

When the motion work is being put together, examine it and see that the white lead or dirt that may have got in the oil holes is all cleaned out before the pins are put in. Try all the pins in the holes, then you will know where all the snug fits are, and can look out for the bearings that are likely to get warm. Until the polish that comes from wear is on the rubbing surfaces they need careful watching. Eccentric rods that are O. K. when leaving the manufactory may be sprung or bent before putting up; see that they are free on the cams and that at the connections to the link they are in line, so that the link will not be twisted out of line and cause some of the pins to cut. If the reverse lever handles hard, it may be caused by a tight fit on some bearing that does not let the oil get down as freely as it should. Examine the suspected parts and if necessary take out the over-tight pins, smooth them off and oil before putting back.

That means a lot of work breaking in an engine, you say? That is true; but you may have to do it anyhow before the engine runs successfully. It is easier to get it done the first day than after she has run a week. The correct idea is to get her ready to do the work in regular service as it should be done.

The responsibility is on the man who has charge of breaking her in, if it is charged that she is cut or injured in the process. Make yourself secure by taking precautions to know just how she is put up.

Until a trouble is located you cannot apply the proper remedy. Do not apply various remedies when you are in trouble from the effect of an unknown cause. Find out the cause if you can, then reason from the cause to the effect, and you can apply the proper remedy. Many an engine has been condemned for not working well without inquiring into the cause, when the trouble could be easily located if a quick-witted man tried to do it.

Valve oil is not needed to cure a hot bearing half as badly as a close inspection for the cause of the hot bearing.

If side rods and crank pins run hot steadily, examine to see if they are in tram and quartered square. A new engine's axle can be sprung the first day under steam just the same as any other day, if she slips and catches on sand. Engine trucks will run warm if they are not in tram; it will make the hubs crowd one of the boxes.

Look out for heavy, solid grease in the oil holes in cold weather and clean it all out. If you will put a few strands of coarse woolen yarn down into the oil holes in engine truck and driving boxes, the oil will feed down freely, and dirt will not. Leave the ends of the yarn sticking out over the box, so you can draw it out to open the oil holes when dirty.

The tender, when filled with coal and water, carries a larger load per square inch of surface on the journals than any other bearing of that kind on a locomotive, and gives less trouble, caused partly by the freedom of motion sideways to adjust themselves and by the method of lubricating them from the bottom of the journal. Take a hint from this and see that the driving boxes have the cellars packed properly—not too tight. You can get at the cellars next the eccentric cams easier before the eccentric straps are put up.

A can with white lead and oil mixed thin, so it will run through all oil holes, is handy to have. Dixon's graphite is A1, also. It gives the bearing a glossy surface in a few trips. Look out that it does not separate from the oil and settle in the bottom of cellars or stay on top of boxes and not flow through oil holes. If the valves are to get any, the relief valves will take it in better than the tallow pipe openings.

A long piece of small hose to reach a hot bearing with a stream of water from the injector delivery pipe or tender is very handy.

But, after all, the boiler gives more trouble than all the rest for the first few days. The oil used in drilling and tapping the holes and that on the staybolts comes off into the water a little at a time and makes the boiler foam more or less. Three or four days' work and a few thorough washings help this. A surface blow-off cock will take out a lot of the scum and oil. If the water foams so badly that she won't handle herself, take off a front cylinder head, stand the engine outdoors in position so steam port to that head will be wide open, fill the boiler full of water with the injectors, have a good pressure of steam and when you open the throttle the water will foam and come out in a solid stream, scum and all. Look out that you don't take out too much and have to draw the fire; it may surprise you. Letting her blow off through the pops when full of scum takes out a lot of it.

A heroic method of getting this grease out in short order is to put a liberal dose of soda ash in the boiler when filling up the first time. Get up steam while putting up the machinery. If she stands all day and is washed out at night the boiler will not give much trouble, as the soda ash will take off the grease the first day, and all the trouble will be in that boilerful of water before she is worked any. Mineral oil is said to be good to bring the other oil off the staybolts and not make any trouble. Some who have tried the plan say it is good; others condemn it.

Oil the jacket and painted work where the muddy water from the stack is liable to strike. When she gets to carrying her water well, you can wipe the oil, mud and all, off and leave the paint fresh and clean.

The lubricator is pretty apt to fill up with dirty water and get the small passages choked up on the first trip if she foams badly. Shut off the cup while boiler foams badly and use the auxiliary oilers; that will be less trouble than taking cup down and cleaning it out. Look out for the air pump, too; muddy water does not help it any.

Take a supply of blocking to use in case of a breakdown, just the same as for an old engine; some spare brasses and a jack to use in changing brasses. If the new engine has not got a full outfit, better borrow a set for the trip. It is an old saying among enginemen that if you lose or leave a tool you always need it on that trip. Maybe having them along helps your luck. Certainly, the man who looks ahead far enough to have a supply of tools and blocking with him will also look out at the present and see that everything is in good order, so that there is no breakdown.

Don't try to pull a full train the first trip; take things easy, and the engine will be ready for service sooner. That is what they bought her for.

A 445 Million Gallon Reservoir.

One of the largest reservoirs ever constructed is to be built by the Chcago, Burlington & Quincy Railroad for the purpose of supplying its engines with water. It will be located five miles southeast of Galesburg, a division point on the main line, 163 miles from Chicago. The reservoir will be two and a half miles long, 1,500 feet wide and 20 feet deep, and will have a capacity of 445,000,000 gallons.

The Wabash Railroad Company are adding eight new stalls to their roundhouse at Peru, Ind., making twenty in all. The cinder pit is rebuilt, and a new coal chute with twenty pockets has just gone into commission. An elevated track brings the coal supply up to the level of the top of coal pockets in gondolas.

Pittsburgh Four-Wheel Saddle Tank Engine.

Our illustration shows a four-wheel saddle tank locomotive recently built by the Pittsburgh Locomotive Works for Jones & McLaughlin, Limited, Pittsburgh. The principal weights and general dimensions are:

Gage of track—23 inches.

Total weight of engine in working order—31,000 pounds.

Driving wheel-base of engine—4 feet.

Total wheel-base of engine—4 feet.

Height from rail to top of stack—7 feet 1 inch.

Cylinders, diameter and stroke—11 x 14 inches.

Piston rods—Steel, 2¼ inches diameter.

Type of boiler—Straight.

Diameter of boiler at smallest ring—36 inches.

Diameter of boiler at back head—37⅜ inches.

Chown sheet supported by crown bars.

Staybolts—1 inch diameter, spaced 4¼ inches centers.

Number of tubes—74.

Diameter of tubes—2 inches.

Length of tubes over tube sheet—7 feet.

Length of firebox, inside—30 inches.

Width of firebox, inside—31 inches.

Working pressure—180 pounds.

Grate surface—6.46 square feet.

Heating surface in tubes—268 square feet.

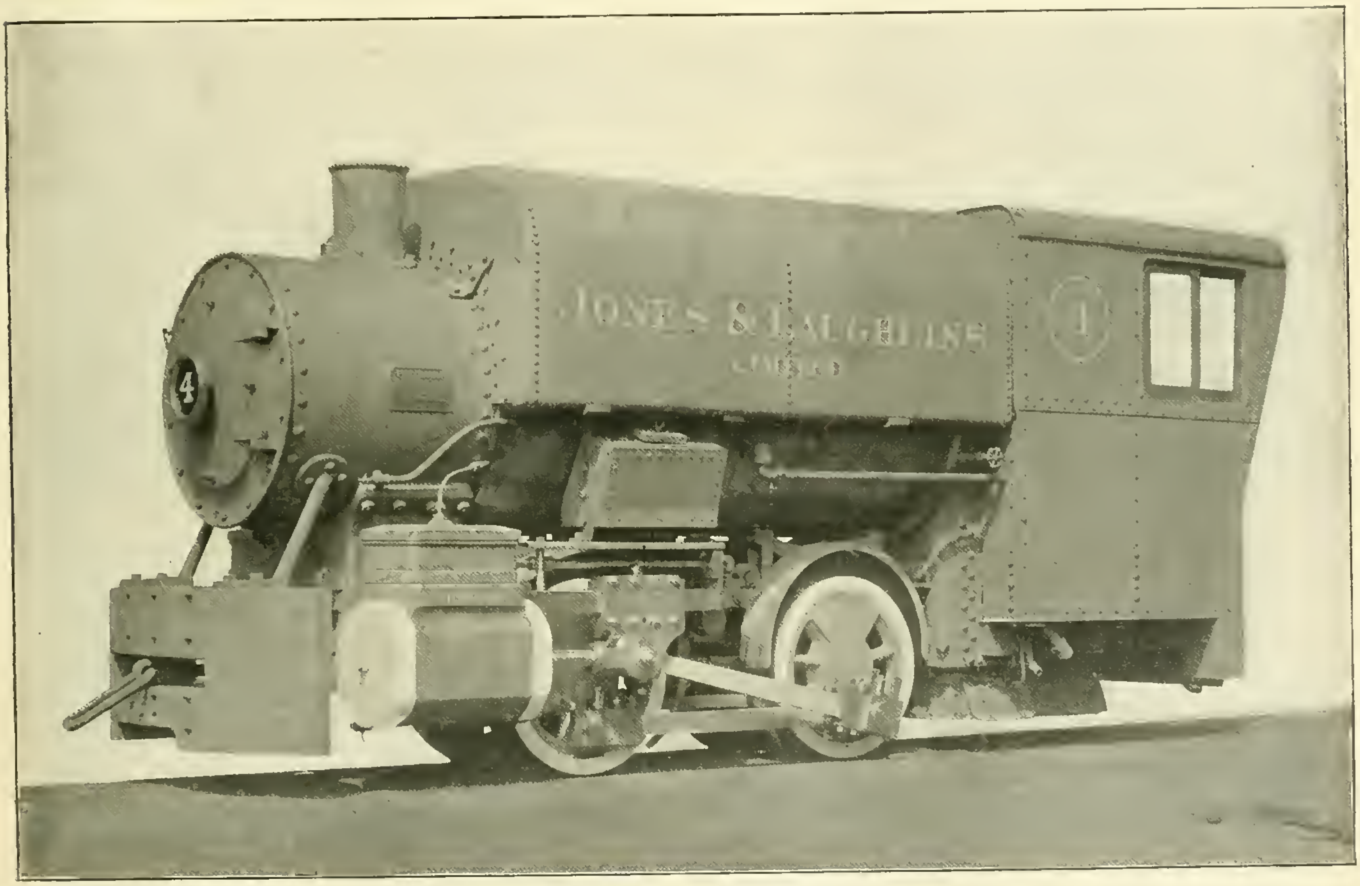
Heating surface in firebox—33 square feet.

Total heating surface—301 square feet.

Diameter of driving wheels, outside of tires—28 inches.

Diameter and length of journals—6 x 6 inches.

Water capacity—450 United States gallons.



PITTSBURGH SADDLE TANK ENGINE.

Boiler Water.

At the rooms of the International Correspondence Schools, 412 Union Trust Building, St. Louis, Mo., on November 25, a practical talk on the above subject was given by J. A. Carney, master mechanic of the Chicago, Burlington & Quincy Railroad at Beardstown, Ill. Mr. Carney was connected with the chemical laboratory, and was afterward engineer of tests for the company, so that he speaks with the authority of experience.

In the beginning of the lecture he described water as to its composition and its well-known quality as the best general solvent, so that in its course over the top of the ground to streams and ponds or in rivers it dissolved a great many substances, holding them in solution, as well as carrying along other substances in suspension.

In its course through the earth, where it passed by percolation through earth or gravel, and ultimately through the porous rocks, it took up large quantities of the soluble salts. Lime, magnesia, soda, etc., in various combinations were all found in the waters from wells.

Granite and trap-rock formations are so old, and there is so little soluble matter in these rocks, that the water from a granite formation is very pure. The New England States are well known for this advantage. Sandstone formations also gave a very pure water when it came from near the surface. Very deep wells in sandstone are not as good; the waters are usually salty.

Limestone rock parts with a good deal of its substance when water passes through it. Alkali waters give the most trouble, on account of foaming. A locomotive boiler foams more than a stationary one, because there is so much less top surface of water in the boiler from which evaporation takes place in proportion to the total heating surface; more steam passes up through the surface of the water. It has been found that when there are 200 grains of alkaline matter per gallon in a locomotive boiler it will foam badly. With a stationary boiler, it can be up to 600 grains per gallon. Carrying the water high up in the shell of the boiler induces foaming.

Organic matter also makes boilers foam badly. Blowing out a boiler to reduce the excess of alkali helps out, as the worst part of the water is the scum which rises and works towards the front of the locomotive boiler. A pipe or skimmer which will take it from the surface at that point is most beneficial; next to that is one near the bottom, which will take out the mud and other solid impurities.

A magnesium chloride gives the most trouble, as it decomposes into an acid in the boiler, which pits and eats out the boiler.

As to boiler compounds—to dissolve the scale when already formed, or to hold the solid matters in suspension in the boiler, soda ash is the base of most of them, although compounds of other materials were used with good effects.

While the correct way to treat the water is to put enough soda ash to neutralize all the foreign matters, yet if this is done in the tenders it would soon make the solution so strong in the boiler that it would foam badly. This called for frequent blowing out each trip and a thorough washing out at regular intervals. If the soda ash was put in the boiler just after washing out, about two pounds was enough.

He laid especial stress on good washing out, at frequent intervals, with a good water pressure. One hundred pounds was better than a higher pressure of water, as the wash-out nozzle could not be properly handled at very high pressures. A lower pressure than 100 pounds would not dislodge and force out all the scale and mud.

Changing Grade of Chicago & Grand Trunk Railway.

It is understood that the Chicago & Grand Trunk Railway is to be sold under foreclosure proceedings in the near future, having the object in view of a reorganization with an increased capital which will provide means to double-track the entire road, and reduce the present grades so heavier trains can be handled with the same power.

This railway has good terminal facilities, runs through a fertile country that is thickly settled, with numerous manufactories located on its line, as well as having feeders which contribute to its through business both East and West. There are but few steep grades, but a large number of moderate ones, which limit the tonnage of trains. Most of the moderate grades can be reduced so that at least 30 per cent. more tonnage can be handled with the present locomotives.

Changing the grades on an established railroad while it is being operated, costs considerable money, but when once finished the outlay is over, and expenses of operation decrease at once. The saving per ton of freight hauled, as well as the reduced expenses of handling the passenger service will soon make up for the outlay. Changing the grades will also eliminate many of the present grade crossings by carrying them over the line on bridges at the cuttings and under the line at the high fills. A separation of grades at the crossings reduces the number of crossing accidents and the expense of maintaining crossing watchmen, crossing material, cattle guards, etc.—things which cause a large expense as well as a perpetual one. Changing grade is paid for only once.

Some years ago when President John Newell, of the Lake Shore & Michigan Southern Railway, began the work of reducing the grades, straightening the line, of eliminating as many of the curves as possible and providing better facilities for trains passing each other, it was thought that the large expenditures would not be repaid by the lessened cost of operation for a long term of years. The results of his policy began to show at once, and long before the work was completed the increased tonnage of the trains raised the amount of the gross revenues, and so decreased the expenses of moving freight per ton-mile that it was proved to be the correct method of increasing the net earnings of a railroad. It cost a mint of money to cut down the hills and raise the embankments in the valleys to make a uniformly level line, but the work done on the Lake Shore will pay for itself in a few years.

The same policy is now being followed on other trunk lines which was so successfully carried out by Mr. Newell, though but few will ever have the courage to carry the work on so extensively, and as a consequence so thoroughly and successfully, as he did.

Our Railroad Managers Will Arrange for International Railway Congress.

The International Railway Congress is an organization with headquarters in Brussels, Belgium, which is devoted to the promotion of railway science. The Congress has members from all over the world. It meets every three or four years for the discussion of subjects that are of the most living interest. Next year it meets at Paris. An attempt is going on to bring the Congress to the United States in 1904, and the various railroad associations have been working to bring this about. The assistant secretary of the St. Louis Railway Club recently addressed Mr. J. Ramsey, Jr., vice-president and general manager of the Wabash, asking about the propriety of the club appointing a committee to aid in bringing the Congress to this country, and the answer given indicates that the matter will be properly attended to by those who represent railroad companies in America. Mr. Ramsey wrote:

"In my opinion the appointment of such a committee is unnecessary, in view of the fact that the American Railway Association, which, as you probably know, is entitled to eight members in the International Railway Congress, has this matter under consideration already, and has arranged for a letter ballot of all the railways of the United States on the question of inviting the Congress to hold its next meeting in this country, and of raising a fund of $30,000 to pay the legitimate expenses connected with the holding of the Congress.

"As the membership of the American Railway Association includes pretty nearly every railway in the United States (not by individual but by company membership) the action of that body would be official and would carry with it the right to assess all of the railroads members of the association with their pro rata proportion of the expenses.

"As railroad clubs simply represent individuals connected with different railroads and cannot bind the railroads to paying any proportion of the expenses of the Congress, it seems to me that the question should be left with the official representatives of the railroads, namely, the American Railway Association."

C. B. & Q. New Passenger Engines.

In October the Baldwin Locomotive Works delivered fifteen large passenger engines to the Chicago, Burlington & Quincy Railroad; ten of them went to the western part of the line, two of them are running out of Chicago. These engines are moguls, having six drivers, 6 feet outside tires, 19 x 26-inch cylinders, with piston valves. The weight of engine is 145,000 pounds, 21,000 pounds on the mogul truck. The traction force is 22,000 pounds. They have a firebox heating surface of 146.2 square feet, a total heating surface of 2,047.6 square feet, steam pressure 210 pounds. As it is steam pressure and heating surface that give an engine her power on a heavy fast train, this engine ought to make good time. She is equipped with the high-speed brake. Most all the Burlington Route fast train engines have this improvement.

Every driving and truck box and the crank pin bearings have a water pipe attachment to use in case the bearings get warm. The eccentric straps are bronze; driving boxes, crossheads and a great many other parts are cast steel. The air pump exhaust is piped to a condenser in the bottom of the water tank; one non-lifting Friedman and one Ohio injector furnish the water supply.

There is a small by-pass controlled by a globe valve in the boiler check case, which can be opened in cold weather to let a small amount of hot water from the boiler into the branch pipe, so it will not freeze up. This device has been used for some time on this road with good results. The tenders hold 5,000 gallons of water and 12 tons of coal.

After these engines get in regular service on the "fliers" we will note their records.

General Correspondence.

All letters in this Department must have name of author attached.

More Irish Engines.

I am very much obliged to you for publishing that photograph I sent you, and I note your remarks about the lack of photographs of Irish engines. I therefore enclose you some more, which I have taken during the past summer, and hope they may be of some use to the paper. The first is a six-coupled goods locomotive belonging to the Midland Great Western Railway of Ireland. The engine has cylinders 17 x 24; boiler, 53 inches diameter; drivers, 63 inches diameter; boiler pressure, 160 pounds; weight of engine and tender, 68 tons. The Midland Great Western Railway runs from Dublin to Galway, with branches to Sigo and Westport. This type of locomotive handles all the cattle and goods traffic on the system. This particular machine is one of the older ones; the later ones have larger cylinders and higher boilers. If I get a photograph of one of the latter I shall send it along.

No. 2 is another photograph of Dublin, Wicklow & Wexford engine 58, taken by me at Kingstown. The gentleman on the foot plate is Mr. R. Cronin, the locomotive superintendent. The building in the background is the yacht club; part of the harbor may be seen behind that again.

No. 3 is a photograph of one of the big ten-wheeler tanks; cylinders, 18 x 26; drivers, 65 inches diameter; pressure, 155 pounds. This one handles the morning and evening trains from Bray to Dublin and back (the two heaviest trains of the day), and during the day brings a goods train down to Bray and back.

No. 4 shows her sister, 54, decorated to take the Duke and Duchess of York from the Carlisle pier, Kingstown, to Dublin, on the occasion of their visit over here.

In a back number of LOCOMOTIVE ENGINEERING I noted a paragraph stating that Dublin was about to indulge in electric cars. I inclose you a photograph of one of the said cars. The installation is now almost complete, and promises in the very near future to be the finest in the world. Wishing you and LOCOMOTIVE ENGINEERING every prosperity for the coming year.

E. L. CLEUGH.

Kingstown, Ireland.

MORE IRISH ENGINES.

Bad Ventilation Changes Character of Light Given by Signal Lamp.

I notice in your last journal an article headed "Curious, if True," and wish to say that it is as true as it is curious, and the responsibility lies, as stated by you, in the fact that the ventilation of the lamps is defective.

The effect is, as described by you, that of making the lens appear a dirty white; so the responsible parties are the lamp makers and the lens makers. It shows beyond a doubt that neither one of them has yet attained perfection in their line of business. I do not believe there is a lens maker in this country to-day that can guarantee a red, green or blue lens that will remain unaffected by the sweating of the lamp.

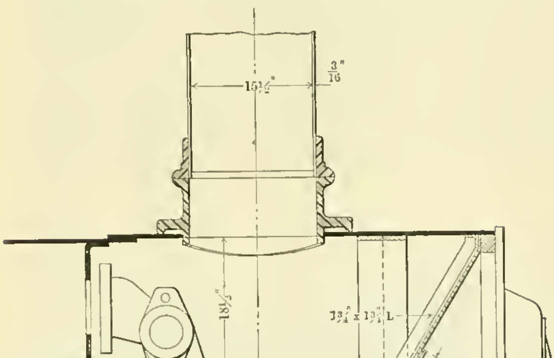
A lens maker who can guarantee his lenses to do so should certainly make his fortune in a very short time, as well as giving increased safety to enginemen and train service. JOHN TONGE.

Minneapolis, Minn.

[The article which Mr. Tonge refers to and substantiates as true reads: "It is said that when the sweat caused by defective ventilation collects on the inside of lamps used for switch or fixed signal lights with colored lenses, that it has the effect of so obscuring the colored rays that when the colored light is first seen at a distance it is apt to be mistaken for a dirty white light. This condition is liable to allow an engineer to run up closer to a colored light before he notes its correct color than is consistent with safety."—Ed.]

The Turner Extension Smokebox.

In your December issue of "LOCOMOTIVE ENGINEERING, I notice on page 531



TURNER'S EXTENSION FRONT.

that you request "the father of the Turner front end to send particulars of the arrangement that is now being applied to some of the locomotives on the Union Pacific Railroad."

I take pleasure in mailing you herewith blueprint showing the arrangement we use on this road, which is practically a duplicate of the arrangement of the Colorado & Southern Railway, as I believe it is from the latter road the Union Pacific received the idea.

About a year ago, while connected with the Colorado & Southern Railway as superintendent of motive power, we began changing a few of the engines from the diamond stack, which was the standard, and as the result was so satisfactory, orders were issued to change all of the engines. Mr. John Forster, who was my successor, can no doubt give you some very interesting figures regarding the economy of this style of front end as compared with the diamond stack.

AN IRISH ELECTRIC CAR.

I would call your attention to pages 27 and 30 of Mr .J. Snowden Bell's paper before the Western Railway Club of Chicago, in September of this year, which illustrates and fully describes the device. J. S. TURNER.

Supt. M. P., Fitchburg R. R.

Boston, Mass.

[The illustration shows the details of the front end so clearly that we do not think any description is necessary. The principal changes are, shortening the smokebox, dispensing with the cinder hopper, perforating the diaphragm plate and setting the netting at an angle from top of smokebox.—Ed.]

The Schenectady Compound.

An engineer who is running or expects to run a Schenectady compound should understand the exhaust valve (sometimes called starting valve). It appears to be of little consequence, except to use when we wish to start—work engine simple or use left side alone. But these are its only uses. When it comes to reporting work on these engines, you will find in the book: "Right main valve cut bad and intercepting valve not working;" another time, "Right balance ring broken, intercepting valve sticking"; another, "Right piston snap rings broken, and something wrong in right steam chest; think yoke or bridge is broken." After taking up chest cover, right cylinder head and piston out, he takes out intercepting valve, and finds them according to blueprint. There is the exhaust valve left on that side, and he takes that down and finds one ¾-inch nut gone that should hold piston to the head, or seat of small valve broken off from slamming. Then the roundhouse man wonders why the engineer did not fix it while the fireman was taking water, and why he reported everything but that. And the following is perhaps the reason: The exhaust valve is located in the front head of the intercepting valve cylinder. It is made with two valves having ground seats, one of a small diameter, the other larger. To open this valve or valves, there is a small cylinder cast on front head of intercepting cylinder. It has piston connected direct to the smaller valve. When air is admitted from small valve in cab, it enters the front end of small cylinder and shoves the small valve open. This relieves the pressure, and a shoulder on the piston strikes the large valve and pushes it open also; then left engine has an exhaust to stack. As long as air is held against this piston the valves stay open; when it is exhausted, a spring closes it up. The piston and small valve are held to piston head by a nut; if it works off the small valve will open, the larger one remaining closed. In this condition engine will make four soft exhausts with a continual blow. As the smaller valve only is open, the receiver will fill up for a moment and shove intercepting valve back just far enough to close live steam ports to low side; then receiver is relieved to right chest, intercepting valve will close again and right chest receive a shot of live steam. This gives the impression the yoke or bridge is broken; the continued blowing that the valve is cut or balance ring broken. Sometimes the valve closes up and engine will be O. K. again for a while. An engineer can tell if the nut works off when not working steam. Small valve in cab being opened to admit air to exhaust valve, his pump will start to run fast and drum pressure go down; for the air will pass direct to exhaust, through hole where piston entered the head. First, see that air pipe is not broken under jacket by disconnecting at union and trying with pipe plugged up.

When running or working steam, cab valve in release position, steam will come out of release opening under pressure from receiver.

If the seat is broken off, or rather valve broken, notice action of engine and intercepting valve and you can tell at once; for a blow from a cut valve on right side would have to be very bad to reduce steam enough in the receiver to move intercepting valve ahead if exhaust was closed.

C. R. PETRIE.

Los Angeles, Cal.

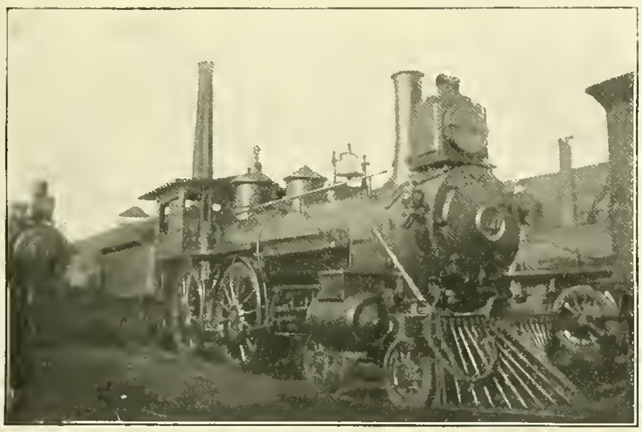
This is a good time of the year for you to make yourself familiar with our Book of Books. Sent on request.

Two Well-known Old Timers on the Old Colony Railroad.

A subscriber to LOCOMOTIVE ENGINEERING recently visited the Plymouth division shops of the New York, New Haven & Hartford Railroad in South Boston, with a camera, and discovered in the vicinity of the roundhouse several locomotives worthy of illustration and mention among the old-timers which have from time to time been presented to your readers, and which, but for your valued paper, would pass into history forgotten and unknown. One, the famous engine of its day, which was considered good enough to bear on its name-plate the proud title of the road itself, "Old Colony." She is now No. 637 of the New Haven road, but the accompanying photograph shows her still to preserve her old lines. Built in 1869 or 1870 for what was then, as in the present day, the star train of New England, the Fall River boat train, she was for years distinguished as the heaviest and most efficient engine on the road. She was involved in a destructive accident to the boat train in 1876, and upon being rebuilt resumed her place on the road, elaborately painted and refitted, continuing to perform leading service until the advent of a series of larger engines, since which time she has gradually sunk in the scale of usefulness, her present duties being confined to light suburban work. The names were eliminated from the Old Colony engines in 1883, but the writer was impressed with their historical beauty and significance as an old-time engineer recalled some of them, pointing out locomotives which had once borne such names as "Pilgrim," "King Philip," "Puritan," "Myles Standish," "Mayflower" and "Plymouth Rock." Another engine photographed, No. 636, was formerly the "Somerset." Mr. Willis, the present master mechanic of the South Boston shops, was identified with this engine for many years. She was built by the Taunton Locomotive Works in 1869.

W. A. HAZELBOON.

Boston, Mass.



TWO FAVORITES BECOMING ANTIQUATED.

Mistakes in Designing Valve Motion.

FIRST PAPER.

BY H. ROLFE.

We have all perhaps at some time in our career fallen into the error of pursuing an idea too far. Speculation, theorizing, call it what you will, points out a certain practice that it is advisable to adopt; we try it and find it good, and then forthwith jump to the conclusion that what is good, administered in small doses, must be correspondingly so when the dose is increased.

This tendency has led many a good man astray; for although the primary considerations that led to the embodiment of said ideas may themselves admit of considerable following up, yet there are certain side issues, not immediately apparent, that militate against the advantages gained.

We may quote as an instance the matter of steam ports for locomotive cylinders. The steam distribution in locomotives is almost universally effected by eccentric-driven slide valves—the earliest form and method used. But these valves have the objectionable feature of opening slowly, both to steam and exhaust; the cut-off also is slow. Now, what is wanted is quick admission; that is, the piston should receive a large volume of steam as quickly as possible, and receive it, too, when the engine is in a position to make the best use of it, which is *not* when the crank is on the center. In other words, the aim should be to secure as large an area of port opening as possible in a given time. Now, *an area* is made up of two dimensions, length and breadth; and since, with the ordinary valve gear, the breadth of opening in a given time is not satisfactory, the only thing to do is to increase the length of the opening—that is, use longer steam ports. This certainly achieves our object; for if in place of a 15-inch port we use an 18-inch one, the piston will get 20 per cent. more steam in a given time. Now here was a fine opportunity to "overdo it," and overdone it accordingly was, designers overlooking certain accompanying disadvantages, which we will enumerate as follows:

1. Waste of Fuel.—The valve being longer, there is greater area for steam to act on. (The fact of its being "balanced," where such is the case, need not be taken into account, for the unbalanced area will be greater in proportion.) Considerable power is absorbed in moving the valves to and fro against the frictional resistance of the seat; the power thus used produces no useful result; it plays no part in hauling the load, which is the one legitimate function of the engine. Wasted work means wasted fuel.

2. Waste of Oil.—The frictional work being greater, the supply of lubricant must also be greater, and herein is a direct loss.

3. Wear of Parts.—The resistance to the motion of the valve adds to the load on the parts between the eccentric and the valve-yoke, and so increases the wear on all the joints; the sooner, therefore, will the valve gear be thrown out and the pins need renewing, holes need lapping or rebushing, valve seats need refacing, etc. It also makes it harder for the engineer to "hook up."

4. Condensation.—A longer steam port (and therefore wider passage) means increased clearance space; it also means increased cooling surface, and, therefore, more condensation. Also, the surface of the steam passage being greater (for a given cross-sectional area), the total skin friction will be greater, which not only makes the steam slower getting in, but also—what is equally important—slower getting out. It must not be forgotten that these steam passages are necessarily rough, just as they leave the sand.

In Great Britain they have never gone in for very long ports, the average length for a 19-inch cylinder being about 16 inches. In this country longer ports have been in favor, the average practice being to make their length equal to the diameter of the cylinder. Of late, however, the tendency has been to use shorter ports.

The most satisfactory way of dealing with this matter of slow and restricted port opening is the adoption of the double-ported valve—the Allen. Another way is to employ a longer travel, and thus get a quicker motion of the valve. This is advisable and desirable in high-speed locomotives, and is sometimes done. There is the objection, however, that as we move the valve further under a given pressure there is more frictional work performed; that is, there is more work wasted. The Allen valve has the advantage of increasing the area of the port opening by the same amount in all cut-offs (so long as the "port-opening" is not less than the width of the supplementary port); whereas an increased travel on a plain valve gives us merely an extra percentage of opening, the gain or port area decreasing, therefore, as the cut-off gets shorter. Piston valves give large port areas without increasing the travel, and they have the additional advantage of being balanced, as regards steam pressures, there being practically only the ring friction to overcome, although this may, of course, be considerable, for there is little doubt as to the steam getting behind the rings and blowing them out against the walls. But the objection of increased clearance (and therefore condensation) still holds, as far as our experience goes; though these may be much lessened in a good design, for this form of valve allows us to locate the steam ports nearer to each end of the cylinder, without adding appreciably to the weight of the valve—an advantage over the D-slide valve. Still, the passages will always be long, the steam on the "far" side having quite a distance to traverse before reaching the cylinder. It must be remembered that there is a difference between long ports and long passages. The difference we refer to may be seen by taking two cases of, say, an 18-inch port, which is placed in one instance near the end of the cylinder, and in the other only a few inches from the center, as with our ordinary slide valves.

Long ports probably allow an engine to do more work, to develop more horsepower at any given speed—to increase its capacity, in fact—but they require more steam (which means water and fuel) to do it. It is within the experience of many that long ports are beneficial in getting high speeds, and certainly when cutting down the steam-port capacity one should bear in mind that it serves to let the exhaust out as well as the live steam in. Cramping the exhaust is a thing to avoid.

Possibly, also, the long-port people may have been influenced by another good intention. They may have borne in mind that as they hastened their cut-off they also hastened their exhaust closure, and so had more steam bottled up and compressed. Their idea then would be to get liberal clearance volume for their steam to back up into, or else "things" might happen. But personally, we have only met one case where the compression attained to anything near boiler pressure, and then there was ⅛-inch inside lap, to say nothing of a lot of lead (⅛ inch in full gear).

There are other points in connection with valve gears wherein "we all like sheep have gone astray," but on which our "sober second thought" (albeit late in arriving) has in due time set us straight.

Doubtful Improvement on the Pony Truck.

In your December number I read an article relative to the great improvement (?) which had been made to the pony truck on an unmentioned road. The improvement, as I understand the article, consisted of the center of the truck being somewhat back of the pin connection in main frame.

I have had some knowledge of the performance of engine trucks so arranged. It is, as the article states, a great thing for going around curves, but how about the straight track? We had one of these engines on our Atlantic City division, and of its actions there I wish to write you. Shortly after this engine was put into service our track supervisor began to notice that the track on the tangents was getting badly out of line for some apparently unexplainable reason. One day, while standing along the track, he noticed an engine coming along, swinging to the right and left in a very peculiar manner. Investigating further he found that the engine with the swinging truck was doing the damage, and by repeated observations was able to prove beyond a doubt that this engine was doing all the damage. The engine was taken off, and no further trouble was experienced; but it certainly did throw the track out of line while it was there. I think this experience is worthy of a place in your paper, for the observance of those who are desirous of trying such "improvements."

F. D. Hain,
Asst. Trainmaster P. & R. Ry.
Philadelphia, Pa.

More about Injectors.

As the injector is prominent in your valuable paper at present, I will submit some very important points on its uses and abuses. There is not enough care taken in sizes and spacing of nozzles, which materially affect the efficiency of injectors. With this properly attended to and proper care taken to make all joints and nozzles tight, very little trouble will be experienced in this respect. In renewing nozzles the most important thing is to see that the proper space is between combining tube and delivery nozzle, and that they are in line, and no rough edge is on delivery nozzle to spray or retard the water; that the hole is smooth, and flare to a smooth finish; that the size of the hole is the proper proportion for its combination, and that it is tight on combining tube. Then in putting nozzle in barrel of injector, that the joints are in good condition and the sleeve screws down solid on delivery nozzle, as any leak there will cause injector to break by coming in contact with stream through delivery nozzle. The steam nozzle comes next, and it is very important to have it the proper size, length and flare; for in this lies the power of injector working under different steam pressures. They are often fitted up and will work at a certain pressure, and are no good at higher or lower pressure. I often experienced this trouble when I first started working on injectors, and had considerable annoyance from new injectors being in this condition. We now have No. 9 injectors I have overhauled (we have a standard nozzle now) that work from 30 pounds' pressure to 200 pounds' pressure, a range suitable for all requirements. The amount of water thrown is also dependent on the proper size of steam nozzle. On a great many injectors, especially new ones, we find the combining tube overlaps the steam nozzle from 3-16 to 5-16 inch. This only gives the combining tube chance to take the pressed water from steam nozzle at the smallest part of its flare, or on looking at one that has been used we find the large flare of tube untouched or doing no work whatever. It also gives smaller space for water to rush in combining tube by taking up its space. The combining tube should be left clear as possible at its large end to allow free access of water. The steam nozzle so flared that the steam from it fills tube ⅜ inch from its end, which insures a solid body of water through injector and an assurance of getting its full capacity. Now for test; our injectors day in and out throw 4,500 gallons of water in 1 hour and 40 minutes on train. This is No. 9. Our No. 8 throws 3,500 gallons in 1 hour and 35 minutes. This is in actual service, and we have very little trouble from the injector source.

Some of the imaginary failures of injectors are amusing. Engineer reports injector don't supply; often we find injector throttle nearly closed, dirty strainer, kinked hose, badly worn tank valve, rod or feed-pipe nut loose. But when such report is made and the injector is all right, everything pertaining to water and steam supply all right, the check valve has too much lift. This is another important point for good working injectors. It is absolutely necessary to have the opening of check of such dimensions that it is less than the full area of check pipe, as this keeps the body of water from injector to check solid. One cause for the supply question is that engineers do not feed their engines regularly, or they fill them at one time, shut injector off and work the water level down too low before putting them on again. This, of course, is done to favor steam, a hard pull, or carelessness. An engine should be fed regularly, or injector worked from one end of the road to the other, except when in side tracks, putting in only what she is using. This saves coal and water, makes an engine steam better, and if carried out, there is hardly any injector that won't supply.

At some other time I will send you my dimensions for the nozzles we are using. As this is a very important subject in our business I am glad to see the interest that is taken in it, and to close I would recommend to any runner who wishes to take good care of his injectors, that the best thing he can do is give them a small dose of black oil occasionally, keep his strainer clean, the packing and nuts tight, and they will do the rest.

Yours truly,

J. J. Flynn.

1423 W. Broadway, Louisville, Ky.

Objects to Wipers Being Made Firemen

Some railroad officials pride themselves that their employés who look for promotion must commence at the bottom of the ladder, and quote the position of wiper as the starting place for the future engineman. Let the future engineer start no lower than machinist helper, either in roundhouse or back shop. I decidedly object to the position of wiper as a starting point.

W. de Sanno.

Kern, Cal.

Question on the Time Table.

Will some of those transportation officers who turn down a man because he cannot define time-table, please tell the readers of Locomotive Engineering what they mean by saying the train was *due* to leave and the train was *due* to arrive?

W. de Sanno.

Kern, Cal.

A Solid Planer.

The L. W. Pond Machine Company, of Worcester, Mass., have recently built six planers for the Woonsocket Machine and Press Company which are out of the ordinary in several ways. They are a small planer—only 30 x 30 inches, but they have a 19-foot table carried on a 32-foot bed. The bed goes clear to the floor and is perfectly plain outside, presenting a smooth surface to the eye, as well as to the paint brush.

The table is also very deep, is cored out for lightness, but is ribbed so as to be extremely stiff and rigid, while avoiding excessive weight. It is one of the most substantial small planers we have seen.

Nicknames for Engines.

Railroad men, especially in the train service department, delight in nicknames for the different classes of engines, some of which are very expressive.

For instance, the old Winans engines on the Baltimore & Ohio Railroad, with cab on top of the boiler up next the stack, were called "camels."

A mogul engine has had the name of "moke" for years. The small four-wheeled switch engines are known as "pups." If the water tank and coal supply were also carried on the engine, they were "dinkeys." Ten-wheel freight engines with small wheels were called "pigs," the larger ones are "hogs."

Consolidation engines with small drivers are "creepers;" while the Wootten type of firebox makes an engine a "Mother Hubbard."

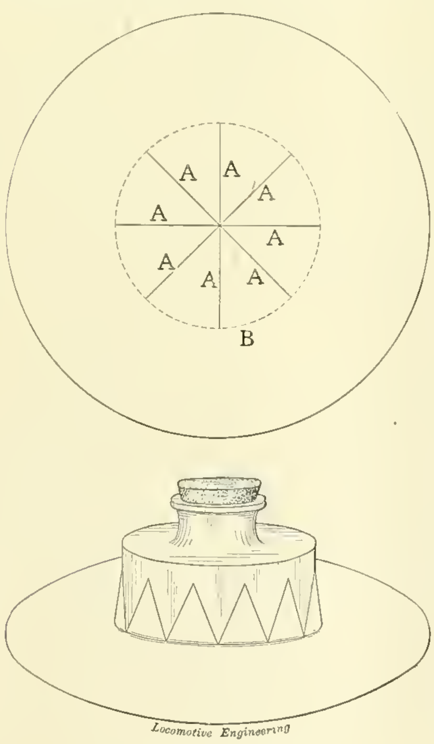
On one Western road the immense Brooks freight engines are called "battleships;" while the large passenger engines are dignified by the title of "air ships."

"Cruisers" seems to be a favorite name on some lines; in fact, since Dewey took the prize at Manila naval cognomens seem to have the most interest.

So far, the compounds seem to inspire enough respect, so they get their own name when the number and type of cylinders comes into question.

Draftsman's Bottle Holder.

It's only an ink bottle—but to prevent it being knocked over or off the table the device is ingenious and cheap.



INK-BOTTLE HOLDER.

Taking a piece of cardboard four, five or six inches round (or any other shape), set the bottle in the middle and draw around it as shown by dotted line *B*. Then, take your knife and cut from side to side of circle, or from center, as you choose. Eight pieces will do, but is, of course, optional.

With these points turned up and the bottle snugly held by them, the danger of overturning is greatly lessened. By putting a thumb tack through the holder and into the board it isn't as apt to go off on the floor either.

Cardboard is the easiest and cheapest to handle, but anything can be used, such as zinc, brass or tin, and can be made as fancy as the maker chooses.

Improvements on the Chicago & Alton.

The Chicago & Alton's new management are devoting a great deal of attention to the betterment of their rolling stock, which became badly run down during the last five years. Among the projects to be carried out is the extension of the shops at Bloomington, Ill. These shops were models of convenience when they were built, but years passing and few new tools coming in have pushed them behind the times.

Among the changes proposed are a new car shop, a central power and lighting and heating plant, and the use of electricity for driving the shop machinery. President Felton, who is a leader among the clear-headed, progressive railroad managers of the day, has a just perception of the value and economy of employing the very best methods and the most efficient tools that can be secured. During his short régime there seems to be a decided improvement in the spirit and sentiments of officials and workmen. They no longer believe that the road is going to the dogs.

Ammonia as a Fire Extinguisher.

Ammonia is coming into favor as a means of extinguishing fires, and we expect that the time is not distant when every manufacturing and industrial establishment will have siphons of ammonia hung up in great numbers, ready for use when a fire suddenly breaks out. These siphons ought to be much in evidence in car shops and other places where much inflammable material is stored.

The instance is noted of a fire having originated, probably from spontaneous combustion, in a pile containing several tons of cotton seed, the interior of which was almost a solid body of live coal, which was completely smothered by the application of a half gallon of ammonia. In another case, which occurred in Savenay, France, the vapors of a tank containing 50 gallons of gasoline caught fire in the linen room of a laundry; the room was instantly in a mass of living flames, but a gallon and a half of ammonia water thrown into it completely and almost immediately extinguished the fire. The effect, as described, was instantaneous, torrents of black smoke rolling upward in place of flames, and in a moment every trace of fire was gone—so sudden and complete, indeed, being its extinction that workmen were enabled to enter the room almost immediately, where they found the iron tank of gasoline intact.

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Indexes for 1899.

The index for 1899 is ready for distribution. Anyone wanting a copy will receive it on making the request.

Piece Work in Repair Shops.

In our November issue we published an article describing the premium plan of paying workmen for extra effort in producing finished work, a plan devised by Mr. Fred A. Halsey and used successfully in various workshops and factories. This has brought us considerable correspondence, and in this issue we publish a letter from Mr. R. T. Shea, inspector of piece work for the Hannibal & St. Joseph Railroad at St. Joseph, Mo. Mr. Shea is decidedly opposed to the premium plan, which, he says, gives nearly everything to the company and a very small share to the workman. But he has nothing except praise for the fairness and justice of the piece work system. He writes evidently under impressions of his immediate surroundings. The Hannibal & St. Joseph people (Chicago, Burlington & Quincy owners) have introduced the piece work system into their repair shops, and they appear to have treated the men fairly, for while the day pay is about $2.50 we are told that the managers of a shop in a nearby town offered $2.90 a day and none of the Hannibal & St. Joseph men accepted the offer.

Mr. Shea makes out a very pleasing picture of the harmonious manner in which the piece work system is operated at St. Joseph, and of the benefits that the men derive from their increased earnings. The most that we have learned from the letter and from a paper contributed by the same author to the Western Railway Club on "Piece Work in a Railroad Shop," is that piece work can be carried on successfully in a repair shop if the conditions are favorable. He says that if the system is properly organized it is better for the men and better for the company. That the only tact required is ordinary business judgment and plain, fair business methods that can't be questioned.

The writer probably has a much wider acquaintance among railroad repair shops than Mr. Shea has had, and he finds that on the whole piece work is not regarded favorably by the officials and is hated by the workmen. In not a few shops the piece work system has been tried and abandoned, and we find very few well managed shops where changing from day work to piece work is under consideration. Mr. Shea gives particulars of two cases which are very significant and are the kind of material that form the reefs on which the piece work system founders. A workman in a wood-working department, whose day rate was $2.50, was given a piece work job, and by hard work and devising helping devices he earned $3.80 per day. The foreman promptly told the man that his earnings were unreasonable and wanted to cut him down. He appealed to higher authority and his right to earn the high pay was sustained. Another case was a man on a drill press, who, by special methods, managed to increase his earnings 50 per cent. Again the foreman tried to cut his wages down, but was not permitted to do so.

These were happy terminations of the disputes, but that is not the way such disputes generally end. The foreman gets his way, and the men are cut down till piece work earnings produced by incessant toil are no better than they formerly were under day work. This is what makes workmen suspicious of piece work. And it is not always from the foreman that the proposal to cut prices comes. In fact, the foreman, as a rule, knows that the men are doing more than a fair day's work, and that they are entitled to receive more than an ordinary day's pay. The proposal to cut prices nearly always comes from officials who know nothing about the hard work and surpassing skill involved in a great increase of finished work. All they know is that the payroll shows that certain men are earning very high wages. Very often these are the most profitable men in the company's employ, but that counts for nothing. An order is given to cut their price, and cut it is Then the other workmen whose capacity for earning high wages is good reflect on what has happened to the other, and he reduces his gait. It may be said that the workman who deliberately reduces his productive capacity is dishonest, but we do not regard it in that light. You watch a man facing a valve. He pushes the file deliberately, but does no soldiering, and is steadily at work until the job is finished. He is doing a fair day's work. Put that man on piece work, and the chances are that he will push the file much faster and complete the job in shorter time. In this case he is giving the work more than natural effort. By night he will be worn and tired beyond those who are merely doing a fair day's work, and it is only fair that he should be paid accordingly.

This practice of stimulating workmen to do their best by paying them on the piece work system has been in vogue a long time. Where workmen are treated justly it has always worked well for both sides, but when prices have been systematically and persistently cut, it has aroused intense animosities, and the employers, as a rule, have got the worst of the fight. An unjust manager must be an extraordinarily clever man if he can beat a whole shopful of workmen and keep it up for any length of time. When the protracted engineers' strike was on in Great Britain, a year or two ago, we heard a great deal about the shortsightedness of the workmen whose union prohibited them from attending to more than one tool, and from performing more than a certain amount of work per day. There is rather an edifying piece of history connected with this system of suppressing a workman's capacity. About forty years ago the machinery trades of Great Britain began systematically to introduce piece work. Fair prices were paid for a time, and the workmen favored the system, for most of them by hard work were able to earn more than they could by day work. Many of them fell into the habit of working as hard as they possibly could, and, of course, their earnings were something to be envied. Then the cutting process began. It went on by degrees, but it did not stop until the most hard working and skillful workmen could earn only about the old day wage, and the slow or moderately skillful workman could hardly make a living. When the discontentment and strife resulting from this condition of affairs gave the opportunity, the Amalgamated Society of Engineers entered into the fight, and they brought partial justice to the workmen. That powerful society has taken good care since that time that mechanics should not be worked up to the highest notch of their capacity. Like all such societies that go on for years without feeling the reproving rod of affliction, that organization became tyrannical; but the older members had learned the sentiment from the hard school of the masters.

Side Bearing Friction.

That the friction of side bearing on cars has considerable to do with the amount of tractive force necessary to move these cars, when in a train, is a recognized fact among those who have made any tests of the matter; but the exact amount of power absorbed by the extra flange friction is not exactly known, as it varies with different cars.

Weak bolsters cause the most trouble, but there are thousands of cars so adjusted that the side bearings carry a large percentage of the weight when empty. This may appear all right to the car department men; but it costs more money to move this car than one in which the truck can accommodate itself freely to curves in the track.

Some cases recently came to our notice on a road which made careful tests with a dynamometer car when establishing the tonnage ratings for loading the engines. It was found that some trains pulled much harder than other trains of equal make-up and equal weight. On looking for the reason, it was soon located. The hard-pulling trains had more cars with the weight which the center bearing should carry put on the side bearings. After a number of tests an allowance was made in the rating for this class of cars. It was not unusual to find that such cars pulled 25 per cent. harder than the free bearing cars.

The same trouble was noted in the passenger service. One of the fast passenger trains was late at regular intervals. At other times, time could be made up easily. On a close examination it was found that two of the coaches had a large proportion of the weight on the side bearings. As they were in a through train from the East, they did not go over this division daily, so the delay showed up when they passed through. These two cars were overhauled, this defect eliminated, and just as good time made as with any other train.

The writer of this once made some tests for tonnage rating up a certain grade, using a train of twenty empty Illinois Central refrigerator cars, weighing 405 tons. A 16 x 24-inch engine took them up a 1-per-cent. grade with ease. The same engine then tried the same weight of load in gondolas of coal, and stalled. The weight was reduced to 335 tons—nine cars—before the engine could get over the grade at all, and to 300 tons before the train was handled as easily as the 405 tons of refrigerator cars, in which the weight was carried where it should be, on the center bearings. The gondolas had their weight on the side.

The car-department men may say that they cannot build the cars so a loaded car will ride on the center only. We do not believe this. They ought to be able to do it, and failure indicates poor designing.

The extra expense of drawing a badly designed or badly built car will pay for considerable new work on the car. All this expense must be met from the same earnings. In the matter of wheel flanges, the saving will be no small amount; and it is worth while attending to it. Extra flange wear should call attention to defective side bearings.

Stealing Inventions.

In a recent issue we mentioned that certain inventors of improvements on railroad appliances that they think are not worth patenting are falling into the habit of sending illustrations and descriptions of their inventions to the technical press for the purpose of giving the publicity that will prevent invention pirates from obtaining patents, and to give unimpeachable evidence of the device having been invented by the real inventor. This is a very good practice, for there are men moving about the country all the time looking for unprotected mechanical devices which they can patent by swearing that they are the inventors. The ordinary procedure is to quietly take out the patent and remain quiet for a few years. Then, some day the patentee or his agents visit a shop where the device is in use—perhaps the place where it was invented. Then he puts in a claim for royalty, and fiery indignation is excited. The man who invented the thing protests that the claim is a fraud, but he cannot tell just the exact date on which the invention was applied to practical use. The legal department makes inquiries and finds that a successful defense is so uncertain that they advise a settlement instead of a lawsuit, and so the rogue and thief secures possession of his ill-gotten gains. It is as bad as picking a man's pocket, but it is not so risky. That is no fancy or overdrawn picture. It is the history of thousands of frauds that have been put upon railroad companies.

In the evolution of important inventions there are many opportunities for the industry of another fraud, who may be termed the developer or imitator. We know many highly respectable men who no sooner see an invention that is likely to prove valuable than they proceed diligently to design something that will get round the patented article without infringement. They have not sufficient originality to invent anything, but they possess a certain kind of mechanical ingenuity which makes them very successful imitators. These are very often the men who reap the greatest profit from inventions that others originated.

The party in whose brain the germ of a great invention originates is very often the man who receives the least credit for the achievement when the final verdict is rendered concerning the invention. It is the pirate, the imitator and the improver who carries away the profit and the glory. This improver, who never had an original idea pass through his head, is really a greater enemy to the real inventor than the man who steals outright. The improver is such a respectable vagabond that he imposes upon those who can supply capital, and talks about the real inventor in a pitying, patronizing tone, which carries the conviction that the knave is a very upright man. There are hundreds of that sort of man living in luxury, while the men who invented the appliances that made them rich are struggling along in poverty and obscurity.

Power Required to Move Slide Valves.

For many years the amount of pressure pushing a slide valve upon its seat was a matter of uncertain speculation, and the uncertainty gave rise to many heated controversies. One side maintained that the valve was pressed to its seat by weight equal to the steam pressure in the steam chest. With a large valve this figured out to be an enormous aggregate pressure, and the alarmist, whose voice is never still when such controversies are raging, asserted that a ruinous proportion of the power developed in the cylinders is wasted in moving the valve. Ten per cent. was spoken of as a moderate estimate. The other side to the controversy insisted that between the valve and the seat there was a film of steam which tended materially to reduce the natural friction of metal to metal, and that the lifting action of the exhaust steam and of the steam under compression gave so much relief that no unnecessary friction interfered with the movement of the valve. This film of steam theory was supported by those who had had experience in handling slide throttle valves. They testified that even in cases where no provision was made for oiling the slide throttle valve, that it could be opened and closed with very little effort; but the men who had watched the valve stem and all the valve connections vibrating when an engine was pulling very hard, and had experience in linking up an engine with full pressure of steam on the valves, became firm believers in the great power wasted in moving the slide valves.

A variety of experiments was tried to ascertain the power required to move a slide valve by people anxious to substitute measurement for guessing, but nothing of particular value was found out until 1888, when Mr. J. A. F. Aspinall, locomotive superintendent of the Lancashire & Yorkshire Railway, carried on a most exhaustive series of experiments with slide valves. He experimented with unbalanced valves, and found that the frictional resistance agreed with the ordinarily accepted laws relating thereto, modified by the counter pressure of the exhaust steam and of compression. Several investigators have experimented in the same line since that time, the most important work having been done by the mechanical laboratory of the Purdue University in 1896, to help a committee of the Railway Master Mechanics' Association that was investigating various phenomena connected with slide valves. That committee made a most elaborate report, which showed that the friction of a locomotive slide valve with about 60 per cent. of the area balanced absorbed about 1 horse-power in moving one valve when the speed was about 20 miles an hour. When the speed was about 40 miles an hour moving the valve used up about 2.4 horse-power per cylinder. The power required to move the unbalanced valves was about double what was necessary for the balanced valves.

The experiments that showed these figures were very carefully conducted, but the apparatus employed was not entirely reliable, and inaccuracies were likely to happen. None of the other experimenters used apparatus that was entirely satisfactory. We are therefore pleased to know that the question of slide valve friction is not considered closed, and that other investigators are trying to find out more about it. At the last meeting of the American Society of Mechanical Engineers a paper by Mr. Frank C. Wagner on "Friction Tests of a Locomotive Slide Valve" was presented. The tests described were conducted at the Rose Polytechnic Institute of Terre Haute, Ind., and were quite novel in several respects. A locomotive was prepared so that only one side could be operated, and the slide valve on that side was worked by an electric motor, the piston having been secured immovable in the middle of the cylinder. Steam was admitted to the cylinder and exhausted at the same periods as if the piston and its connections were operating.

The power used to drive the valve was obtained by measuring the electrical power delivered to the electric motor, and making suitable allowances for the efficiency of the motor and the friction of the transmitting mechanism. This was done as follows: After the tests were completed, the valve stem was disconnected, and the electrical power required to drive the electric motor and transmitting mechanism was determined for various speeds. The efficiency of the electric motor under various loads had previously been determined in the laboratory. By comparing the efficiencies at the two loads, the increased loss of power in the electric motor when driving the valve over and above the lost power when the valve was disconnected, was determined and allowed for.

The valve had 157.25 square inches of gross area, of which 54.5, or close on 30 per cent., was balanced. Reports were made of two series of tests, one with a steam chest pressure of 42.18 pounds per square inch, the other with 122 pounds per square inch. In the first case 1.55 horse-power was expended in moving the valve, and in the second case the valve took 3.31 horse-power. This approximates the conclusions reported by the committee of the Railway Master Mechanics' Association, and that of other investigators in the same field of research. Although the tests were not on a locomotive doing work, they suggest a means of measuring the power required to move a slide valve that may be utilized on a broader field.

Limitations of Patents.

Our old correspondent, Paul Synnestvedt, who graduated through the classes of locomotive engineer, air brake inspector and consulting engineer to the position of patent attorney, has been enlightening people on patents through a paper contributed to the Western Railway Club on "Patents: What They Are Not." The paper is very seasonable, for there are a great many inventors who think the granting of a patent by the United States Patent Office carries with it the right to make and sell the article patented exactly as the description and claims went through the hands of the examiners. When suits are brought against the makers of patented articles for infringement of other patents it is very common to hear the complaint made that the Government had no right to take the money from a patentee and grant him a patent on an invention already covered by a patent. What inventors ought to be more familiar with is the relation which a recent patent bears to one granted previously. There are two distinctly different species of patents, one of which is called a generic or foundation patent, the other a specific patent, which may be an improvement on the whole or a part of the generic patent. Mr. Synnestvedt makes the difference in these kinds of patents very clear by describing a hypothetical case, as follows:

"To illustrate the distinction between what is known as a generic and what is known as a specific patent, and the rights of the parties holding the same, let us take, as an example, the case of a car coupler. Suppose A invents an improved vertical plane coupler or drawbar, comprising, essentially, three parts, a *head,* a *knuckle* and a *locking* pin. Suppose he is the first who has ever employed such three parts in combination in a coupler. He is entitled to and can procure a patent upon the combination between a head, a knuckle and a locking pin, his claim being entitled to the broadest interpretation by the courts.

"Suppose B now takes a coupler made in accordance with A's invention, and, in using the same or studying upon it, works out a different form or arrangement of the locking pin and knuckle. B is entitled to procure, on the filing of proper papers, a patent on his invention, claiming his specific or particular improvement on A's generic invention. The existence of A's patent has not had, and obviously should not have, any effect at all in preventing B from securing a perfectly valid patent on the specific improvement which he has invented; for a patent, be it remembered, does not grant the right to *make* or *use* an invention, but only the right to prevent others from doing so. The government has given B a patent on his specific improvement, although it is to be remembered that there has been a prior generic patent issued to A, broadly covering all couplers employing a combination of a head, a knuckle and a locking pin. B's patent, therefore, does not give him the right to make or use his own invention, because his invention cannot be made or used except in making or using the invention which is already patented by A. Obviously, if this were not so, the value of A's broad patent would be destroyed as soon as anyone patented an improvement upon it.

"The enforcement of such a rule would practically upset the whole patent system, since nearly every invention is or may be broad or generic to others in the same line which follow after.

"What the Government does give to B is simply the right to *prohibit anyone else* from using that which he originated, or his particular contribution to the art, which in this case was a specific improvement upon the locking pin or knuckle of A's coupler. A, until his patent expires, can, if he chooses, entirely prevent B from putting his invention in practice, for the reason that B's invention is of such a nature that it cannot be used except in conjunction with the invention made by A. In the words of the patent practitioner, it is but one specific form of a generic structure, of which A holds the monopoly."

Engineer, Mechanic and Contractor.

A speaker at an engineering meeting in England a short time ago was trying to make it plain to his hearers the exact functions of various members belonging to and connected with the profession of engineering, a matter concerning which very loose views are held. There are very few people who have anything like an exact conception of where the duties of a mechanic end and those of the engineer begin. In many respects the two lines of business overlap each other, but there are recognized distinctions between the work of an engineer and that of the mechanic.

Engineering practice means the design and execution of works in respect to their structural fitness for the purpose they are required to serve. That covers the requirements of the Council of the American Society of Mechanical Engineers in regard to applicants for admission as members. The mere guiding or directing sources of power into ready-made channels is not regarded as engineering. There may be a great deal of engineering in the designing of an automatic bolt-making machine, but there is none in the turning out of a thousand bolts by its means. There may be a great deal of engineering in the preparation of a standard design for a railway bridge, but there is none in copying that design when it has been schemed out. Those who adopt and construct things which others have designed may be serving a useful purpose in the world, but their work is that of mechanics, not of engineers. The performance is not much of a higher order than that of turning out the bolts from the bolt-making machine.

In civil engineering the work of the engineer is clearly distinguished from that of the contractor, but there is often more true engineering done by the contractor than there is performed by the engineer who worked out the designs. In this case the engineer frequently leaves tremendous difficulties to be overcome, which call for greater originality and fertility of resources on the part of the contractor than were required in the designs submitted by the engineer. In cases of this kind, and they are always happening, the contractor, while not recognized as an engineer, performs the highest kind of engineering duties.

Bad Time for Making Trifling Changes on Locomotive Designs.

The master mechanic who always wants a few changes made on new engines ordered is in an uncomfortable position at present. We all know that there are many men so constituted that they cannot possibly say "that is well enough." This is the peculiarity that leads to the improving of all standards, just changing them a little to display the originality of the man with the power to do so. These men may have consulted with the engineering department of locomotive works in January about the specifications of new locomotives they are ordering. The engines were delivered in June, and in July a new order was to be given out. The same makers were likely to receive the order, and the master mechanic goes to talk over the specifications, and proposes a lot of trifling changes that will effect nothing of importance except to make the old drawings useless and raise the necessity for a new set. Locomotive builders are too busy at present to have any patience with the man who wishes to make changes without good reason. The tone prevailing is "we can build engines to the old drawings, but we are too busy to make changes."

A curious fact in connection with the well-known appearance of the fracture of a piece of malleable iron is that, if after it has been annealed, ready for service, it is heated to a dull red and dipped into cold water, and afterwards broken, the fracture looks exactly like steel. However, it does not possess all of the qualities of steel, if it does show the appearance of it in the grain, as it is much easier to break after the second treatment than before. The test may, however, be found convenient under certain circumstances.

Notes of Southern Railways and Shops.

EDITORIAL CORRESPONDENCE.

The Texas & Pacific shops at McDonoughville, La., which is across the Mississippi from New Orleans, are not imposing in appearance, but there are some points about them that reflect credit on Mr. C. M. Babcock, the master mechanic in charge. The Texas & Pacific has not reposed in the lap of luxury during its career as a corporation; in fact, it has existed in a hand-to-mouth condition most of its days. Keeping the trains moving and the motive power in a condition to pull trains has vexed the days and shadowed the nights of the mechanical officials. It was a hard task accomplishing that, but somehow it was done, and now the motive power is looking as well as that belonging to richer neighbors, and the miracle of doing something with nothing almost has been performed.

In one respect this letter resembles many of the dispatches now coming from South Africa, which are marked "delayed in transmission." This letter was delayed because my note book happened to be in the pocket of a coat that was laid away for the summer. It has turned up now, however, and I shall proceed to put together a few belated notes of divers things seen and endured in the Sunny South in the middle of summer.

On a scorching July day, when the rays of the sun beat upon parched earth and news gatherer alike with undiminished intensity, when the super-heated air recoiled from the hot ground and danced in grouped waves that seemed searching for some moist thing to dry up, I found myself rambling about on the southern bank of the Mississippi opposite New Orleans, looking for railroad shops, where I believed old acquaintances were to be found. By persistent walking, for there was little other means of transportation, I found McDonoughville and Mr. Babcock.

The shops are small and, according to modern ideas, badly designed, but the people in charge have labored very successfully to overcome the original drawbacks. Numerous devices have been introduced to lighten labor and to facilitate work, and they are able to give light repairs to engines and cars as cheaply as the performance of much better equipped shops. A very successful enterprise carried out by Mr. Babcock was the building, out of old car material, waterproof sheds for the storage of engines not in use during the summer. The moist climate of the South is exceedingly destructive to iron and steel left exposed to the weather, yet a lot of engines belonging to the Texas & Pacific that were not required for service during the dull season were left out of doors nearly all summer until business "picked" up in the fall. This happened because the officials would pass no requisition for "housing facilities," and the engines got into bad order standing outside nearly as fast as those that were hauling trains every day. When Mr. Babcock found that he could not obtain storage buildings by requisition, he began collecting material taken from cars that were broken up and in a short time had sufficient to build sheds for the storage of all the engines laid up. It was admitted that the saving on damage to engines during the first summer was sufficient to pay the whole cost of building the sheds.

In my travels through the South I have frequently marveled at the apathy displayed about protecting rolling stock from the ravages of the weather when not in service. The erroneous conclusion is often reached that because the climate is mild exposure to the weather is of little consequence. I am inclined to think that a locomotive suffers more from standing outside for three months in Louisiana than it would be damaged by standing for twelve months in a siding in Manitoba. The railroad officials say that it is difficult to get cheaply sided and covered sheds to stand the weather. A common practice has been to use sheet iron for siding and roof, and it corrodes to be worthless in a couple of years. There are now cheap cardboard composition coverings upon the market which are almost impervious to the action of the weather. A shed covered with that material would pay the cost in a year or two.

Mr. Babcock follows a practice with worn locomotives that I have not observed elsewhere. He has a mixture of heavy and light locomotives, with the wheel centers of uniform size. The tires cannot be safely run very thin on the heavy engines, so when they get down to about 1¼ inches he removes them and uses them on the light engines till they thin down to ⅞ inch.

Compressed air is used for numerous purposes in the shop, besides changing cars over a large yard. For want of an air compressor he uses a compound air pump and works up a pressure of about 130 pounds per square inch.

A very simple and efficient practice in use here in connection with air pumps is the putting between the governor and the engineer's valve a cup filled with a sponge and horsehair. This catches the dirt that usually interferes in a short time with the action of the governor, and trouble from that source is almost unknown.

Another unusual practice in vogue on the Texas & Pacific engines is a rail washer for washing the sand off the rail after the driving wheels have passed over it. Many a train has stalled on a hill because the wheels of the cars were clogged up with superfluous sand. Another incidental advantage of the rail washer is that it wets the rails on the heaviest pulls, which does a great deal to reduce wheel friction, especially in rounding curves.

ATLANTA & WEST POINT SHOPS AT MONTGOMERY, ALA.

By a cordial invitation received from Mr. George C. Smith, president of the

Atlanta & West Point, I visited the new shops recently built for the company at Montgomery, Ala. The work of installing the tools was not finished when I was there, and things looked as they generally do when builders are defying the rules of order and neatness; but Mr. R. H. Johnson, master mechanic, was striving heroically to push forward the repair work and to defy the inconveniences of building operations.

The shops are remarkably well designed, built of substantial stone and brick, have steel roofs, abundance of light and are to be equipped with first-class tools, whose work will be supplemented and advanced by numerous labor-saving appliances operated by compressed air. The shops are designed to take care of about fifty locomotives and 1,000 cars, although the equipment of the road is considerably short of that at present. The plan of the shops is as good as anything to be found in the country. The roundhouse, a building designed for twenty-one stalls, is a short distance away from the leading track, from which short tracks lead to the different buildings. On the way to the roundhouse an engine takes on coal, water and sand before reaching the ash pit. The other shops, including the transfer table, which serves the car shop, form nearly a parallelogram, the machine shop being at the end nearest the roundhouse. It has five stalls set across the shop, the machines being in the other half. The company now has thirty-three engines, and as it is reckoned that 10 per cent. of the power will be in the shop all the time, this provides a good margin for the future, and the shop is susceptible of easy extension when the period of expansion comes about. Tracks lead direct to the stalls without the intervention of a transfer table. The boiler shop and blacksmith shop are situated in convenient proximity to the machine shop, and are both reached direct by tracks. Beyond the machine shop is the car shop, a building 62 x 207 feet, and at the far end of the car shop are the paint shop and coach shed, under one roof and built at right angles to the other buildings. The whole plan is remarkably compact.

The yards are very thoroughly traversed with air pipes, which supply the power for a variety of purposes. Big air reservoirs are located at various parts of the yards, which prevent dropping of pressure at points distant from the main supply. The passenger car shop was in good running order and they were doing a great deal of work. The practice of painting by spray is in high favor here, and I was told that a boy can paint a freight car in twenty-five minutes. They are putting the Murphy roof on all their freight cars, and speak highly about its efficiency and durability.

They have a fine Bodley engine driving the machinery, and, curiously enough, it is run backward. That, of course, gives the same movement to the piston and crank as a locomotive has in forward motion. Mr. Johnson insists that the engine does better that way than in the other direction.

They have an old Sellers steam hammer in the blacksmith shop which is operated by compressed air. The air on its way to the hammer passes through coils of pipe that are kept heated, so that the air is perfectly dry, and supposed to be warm, when it reaches the cylinder. The men who were working on the hammer talked quite favorably about the arrangement, and said that it prevented them from getting burned, as they sometimes did with the water dropping from steam hammers.

In connection with the shops there are remarkably handsome offices, located at the entrance to finely laid out grounds and just outside of the car shop.

Not far from the repair shops are to be seen the freight terminal of the company. From the short inspection that I was able to give the yard and buildings of the terminal, I readily concluded that they were the finest I had seen south of the Ohio river, and there are few that equal them anywhere. The forwarding and receiving departments each have a building 400 feet long, with all the best known accessories and conveniences for handling freight with promptness and dispatch. The general offices of the company at Montgomery are at the end of the terminal, and are accommodated in a building 45 x 158 feet, most handsomely finished within and without. If the officers of any moderately sized road contemplate building new shops or freight terminal, I should strongly advise them to look over the Atlanta & West Point plants at Montgomery, Ala., before deciding upon their plans.

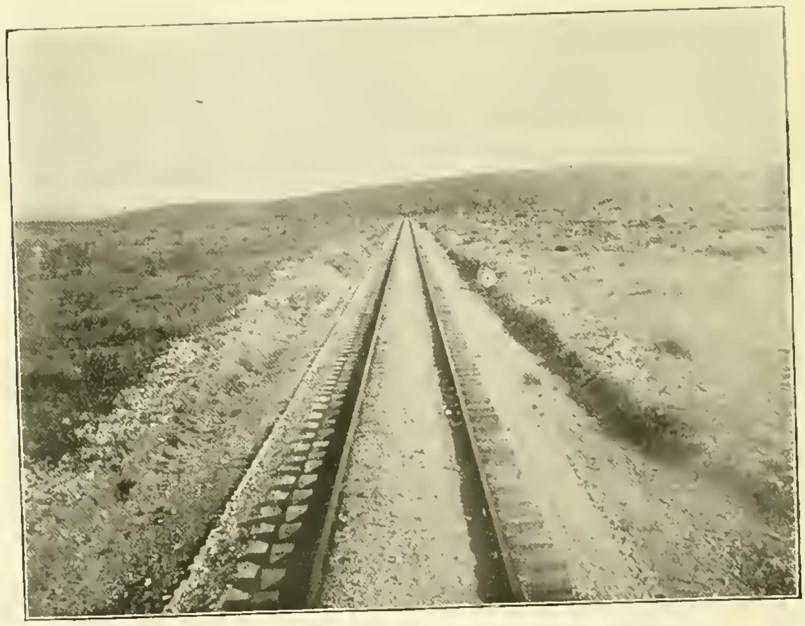
A Few Shop Notes.

At the West Albany shops of the New York Central road we find they are now using aluminum numbers for passenger engines and brass on freight.

They are also using extension piston rods in all cylinders from 18 inches up. These have solid brass bushings 10 inches long, bored to a running fit. They are bolted on with six bolts, and are turned as they wear. Cylinder boring is said to be much less frequent than before this was adopted. A water groove in the packing rings also gives good results.

In the sheet metal shop they have a neat little multiple punch for boiler jackets. It is operated by hand and punches eight holes at a time ⅞ inch apart. There is a neat spacing device so each series of eight holes comes in the right place.

We recently saw a very convenient wrecking car, or rather wreckers' car (for it was solely for the men), under way at the Lehigh Valley shops at Sayre. There were berths for twelve men, and ample accommodation in every respect, including the dining room. The foreman of the wreckers, Mr. Foley, was quite proud of his car, as well he might be. Each man has a signal bell in his house, and they have a record of pulling out at night in twelve minutes after the alarm was sounded. Pretty quick work this.



VIEW ON SOUTHERN PACIFIC RAILROAD, NEAR MARATHON, TEXAS—75-POUND RAIL, SERVIS TIE-PLATES.

The Union Pacific People have the slide valves of nearly all their locomotives balanced, and they have a very good plan for adjusting the rubbing plate. Four studs are screwed through the steam chest cover into the rubbing plate, and adjustable jam nuts are used to adjust the plate exactly the proper distance to clear the valve.

Adventures of an Engineer in Tropical America.

FIFTH LETTER.

While my companions were "taking in" the town and enjoyed their Christmas Eve to suit their own fancy, my Spanish host invited me to partake of the "grau baile," the function of the evening, but I preferred the seclusion of my own room, from where I could listen to the sweet strains of the guitars below, from time to time indulging in a glass of champagne, which my host brought up to me, amicably patting my shoulder as he did so: "Poorecito, mucho sueño" (Poor fellow, very tired). My reveries led me back to Broadwayand to the State I love best of all—the land of alfalfa and steam beer; and with the music gently filling the air, I gradually was lulled to sleep, and awoke in the morning to find myself appointed commandante by my rebels. They had partaken of too much "white eye" (whisky) the day before and were hard to manage, as the native police had an opportunity to find out; but I succeeded in getting things straightened up within a few hours, and thus found myself monarch of Gualan for the time being. A message informed me that Colonel Cramer had left Guatemala City and was on his way to Gualan to settle our claims at once; however, we did not expect him until three days later, so in the meantime I visited some of the beautiful coffee plantations in the neighborhood. Mr. Papadople, a Greek by birth, but naturalized American, who fought in the civil war, and had for twelve years past owned a coffee plantation in Gualan, showed me around his premises, and told me many an interesting feature about the people and their customs. He also told me to be prepared for trouble in my dealings with Cramer (a former Colonel in the Salvadoranean army), who was noted for his meanness and brutality; but I reassured my new friend by telling him that I could handle Cramer and a dozen like him.

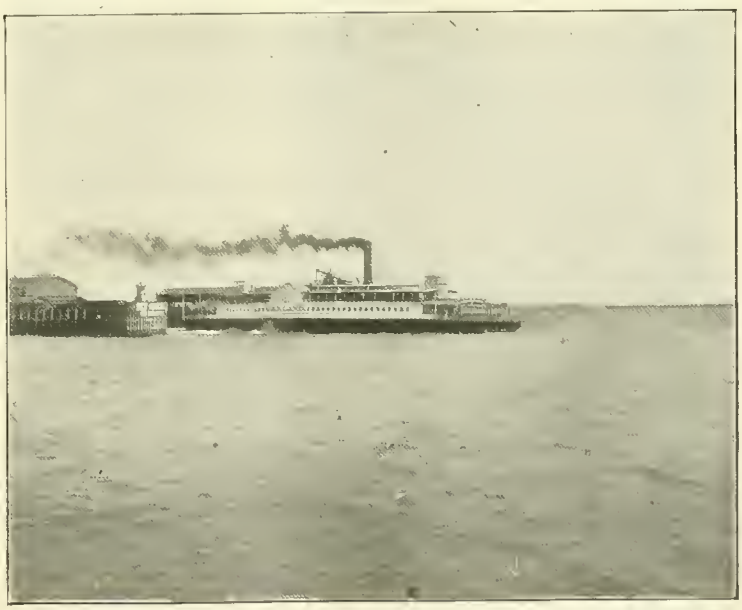
VIEWS ON SOUTHERN PACIFIC RAILROAD—HOTEL DEL MONTE, FROM THE ROSE GARDEN.

During my short stay in Gualan I had become quite attached to it. The place was situated on the "camino real" (royal road) to Guatemala City, and afforded the main resting place for mule teams from and to the Caribbean coast towns.

At the end of three days we sighted Cramer's procession, which approached in the shape of a caravan in the desert—Cramer ahead, followed by soldiers and a number of mules strapped with silver forming the rear. When Cramer was ushered into my presence a few minutes later, he asked, in his broken English, if "dis vas Holland," whereupon I introduced myself as the individual desired, and learned from him that he had been sent to settle our accounts "shoost as he pleased," and that in case of any arguments he would at once call upon the reserve soldiers from Zacapa and have us all shot. This threat at once roused my Yankee blood, and being by no means willing to submit to his authority, I doubled my fist and told him if he would repeat his words I should kill him on the spot. The big Dutch savage saw that I was in earnest and did not repeat them, but "took water" and offered to pay me in full, whereas my mates would have to content themselves with one-half of their claims. To this arrangement I agreed.

On reaching my room I at once proceeded to make a few changes in the books in a way that where thirty days were set down I marked sixty, and in all instances doubling the amounts of the wages, which was quite safe for me to do, as Roberts and I alone knew the affairs, and the former was safe in jail. When my task was completed I felt that I had done a good deed, besides adding to the proofs that Yankee ingenuity is above German trickery.

I posted all my men as to what they should demand when their names were called out, and it was amusing to hear Cramer ask: "How much is coming to you?" When the reply came: "One hundred dollars," where in reality only fifty were due. "Vell, I vill gif you fifty; vill you take it?" Naturally the answer was, "Yes," and in this manner all my employés were paid in full.



VIEWS ON SOUTHERN PACIFIC RAILROAD—FERRY STEAMER "OAKLAND," SAN FRANCISCO BAY.

On the same day I received a telegram from the president of Hackmeyer & Co. to appraise all the property connected with the canal. My old friend, Mr. Miller, contractor of the railroad, was passing through Gualan just about this time, and he told me not to appraise it too high, as he had an option to buy it. I gladly promised to comply with this request, not being in love with the Canal Company anyhow.

The following morning I bade goodbye to my faithful companions, and with a few old negro servants started down the river with Cramer. My present trip was more pleasant than the first one, and having my valise well filled with silver, I decided to return to the United States after reaching the coast. In another week we were back at the canal, and I soon had an invoice of all material and machinery appraised and ready to hand to Mr. Miller. Arrived at the coast, I had my final settlement with Cramer, and when bidding him farewell, advised him to tell Hackmeyer & Co. that he was not up to Yankee grit after all.

On account of quarantine, I could not leave at once for the United States, and went back to my old business—running an engine on the new line. During the six months of my absence Puerto Barrios had met with many improvements; new houses and shops were added and also a wharf and a depot, while the road had been going on at the rate of a kilometer a day. I was appointed superintendent of motive power on this road, which position I held for nearly four years, though the climate was very unhealthy and the death rate greater than in the ill-reputed towns of Panama and Colon. Yet these four years were the most enjoyable and most interesting ones I ever spent. My position as superintendent was a more important one than the same office in the United States, as I exercised absolute control over all departments, while in the States the motive-power department is mostly run separately.

As before stated, the climate was probably one of the worst in the world, and with few doctors and bad hospital service the death rate was appalling. A person that once crossed the "Bridge of Sighs" which led over a small rivulet to the hospital, was surely doomed and never expected to return. Many a skillful American mechanic or engineer found his last home in "Monkey Hill," where nature kept his grave green the year round.

An old companion of mine, by the name of Fairfield, who for years had lived in the wildest parts of Africa, could not resist the fever atmosphere of the Puerto Barrios swamps. We were runners together, and became quite attached to each other when he was taken sick with the dreaded fever. Every evening I walked up to the hospital and spent hours at his bedside, trying to cheer him as best I could, but he told me that he would never again cross the "Bridge of Sighs" alive, and he predicted the truth. He was sinking rapidly, and one bright morning I helped to carry the body of my old mate to his last resting place on Monkey Hill.

During the earliest construction of the road it was a custom among all Americans, when one of their countrymen died, to lay off and attend his funeral; but the deaths became so frequent that only a few of us could pay the last respects to the dead, for the work could not be neglected for funerals. We had no priest nor preacher to perform the funeral rites, so this sad office fell upon me, and after spreading the Stars and Stripes over the coffin, I read the last service over many of my countrymen before they were laid to rest.

VIEWS ON SOUTHERN PACIFIC RAILROAD—MAGNOLIA AVENUE, RIVERSIDE.

VIEWS ON SOUTHERN PACIFIC RAILROAD—ARIZONA GARDEN, HOTEL DEL MONTE.

The fever was more or less epidemic, and in order to be in a measure protected against it the system required a certain quantity of alcoholic drinks, and this necessity explained the frequency of "jags" among the railroad men, which condition in its effects could hardly be distinguished from the "calentura," as the fever is called by the natives. The consequence was that it was hard for me to tell when passing through the shops and roundhouse whether my employés were intoxicated or had the "calentura"—at all events, I always gave them the benefit of the doubt. In one instance, however, not alone I, but also the medical men, were badly fooled, as will be seen by the following incident.

There was at one time in my employment a machinist by the name of Fairchild, from New Orleans, who; from the minute I met him, struck me as somewhat peculiar, and forthwith I concluded that his was a case of calentura. Upon my inquiry whether the disease was prevailing in New Orleans, he answered in the negative, and pretended to have caught it on the steamer. During the two months that Fairchild worked for me he always seemed to have the one or the other of the above mentioned maladies, and the general foreman was of opinion that the poor fellow was subject to calentura. Of course, I did not contradict him.

One evening I was told that Fairchild was dangerously ill, and when I hurried to his bedside he told me that he was sinking and felt the end approaching. After ascertaining that I belonged to the same fraternal society that he was a member of, he expressed a desire to make his will, and I at once sent for the doctor and the general manager, who brought his stenographer. The doctor pronounced Fairchild dying, and told him to make his last arrangements; so the will was set up and witnessed in due form. Twenty-five thousand dollars in property were to be distributed among his relatives in the States, while the general manager and I were willed $5,000 each. This important duty complied with, we all retired, as Fairchild seemed to drop off asleep, and to all appearances would have no struggle, but go out with the tide. I left orders with the watchman to lower the flag at half-mast when the end came, and to call me when all was over. When I awoke it was eight o'clock in the morning, and the sun shone bright into my room. I hurried to my office and asked at once if Fairchild was dead. My stenographer told me that he was working in the roundhouse. I repeated my question and received the same answer, which brought me to the conclusion that the stenographer must have the calentura himself. Then I turned towards the shops, and there, to my disgust, beheld Fairchild taking down the back end of a main rod brass. Everybody had a smile on him, and I asked my friend Paddy McNulty, the blacksmith, if I was dreaming, but he told me this was an old trick of Fairchild's, who drank a gallon of cognac the day before, which invigorating fluid, together with a quantity of green bananas and the morphine injected into his veins by the doctor (to allay his sufferings), had caused in his brain the vague impression that he owned the world. There were the general manager and myself out $5,000 each, and in my disappointment I at once fired Fairchild and took up a general collection to send him back to God's country, where they don't have such things as calentura.

VIEWS ON SOUTHERN PACIFIC RAILROAD—MIDWINTER ROSES, HOTEL DEL MONTE.

VIEWS ON SOUTHERN PACIFIC RAILROAD—MOSSBRAE FALLS.

The Hancock Inspirator Company, Boston, Mass., is the first to send us a 1900 catalogue, and it contains enough information on inspirators to make every practical railroader want a copy. There are sixty pages—9 x 12 inches, of course—and in addition to the inspirator end of the business several specialties are shown. Among them is the Hancock shaking grate, with water tubes. They are made for both locomotive and stationary boilers, and are being used very successfully in the engines of the Boston & Maine road which are burning coke. This fuel requires an extra large air space, and these give 54 per cent., including the water tubes. The increasing use of the Hancock composite inspirator makes this portion of the catalogue especially interesting. Ask for catalogue "B."

Sand Pipe Arrangement.

The Wiggins Ferry Company, of St. Louis, Mo., have a good many six-wheel switch engines with the driver brakeheads cast with a recess in the side opposite the shoe, through which the lower end of the sand pipe passes. This insures that the end of the sand pipe will come exactly over the rail, as the flanged shoe keeps it in the proper position. The shaking of the shoe each time the brake is used tends to jar any sand loose that may be in the pipe, but it probably will not affect wet sand up in the box, in case there is any there; if it would, the device would be invaluable.

It was invented by R. H. Johnson, and we understand is not patented, so that anyone can try it.

The Baldwin Locomotive Works, Philadelphia, met with quite a loss in the big fire in Philadelphia recently. Their publications were in the hands of the J. B. Lippincott Company, and the fire leaves them destitute of cuts for the present. They have the originals, however, and new ones will be ready shortly. In this respect they are more fortunate than we were a year ago—both originals and plates were destroyed. We extend our sincere sympathy.

What is a Good Workman?

DOING WORK TOO WELL. SKILL GUIDED BY JUDGMENT.

When we wish to pass a pleasant hour of mental recreation we frequently turn to a work which affords us an endless fund of amusement of a profitable character. This is reading Chordal's letters, which seem ever new and ever applicable to existing conditions.

Twenty years ago, in 1879, the country was emerging from a prolonged industrial depression, and conditions were very much like what they are in the United States to-day. That year Chordal wrote:

"Good workmen are not only getting scarce, but they have been scarce for some time. A good workman is generally a good, common sense man in every way; and when the panic struck the trade he showed his sense by making other arrangements. The consequence is that today an increased business finds that the only source of special supply is a mass of material first discarded from the shops on account of their being the least valuable. Those who have served their apprenticeship during the dull times have become discouraged at the small wages they were to receive as jours, and if they were ambitious they quit and abandoned the trade. This left the slouchy cubs in the shop. Those short-sighted employers who think they can make money out of the machine business if they can only get at low enough wages have had their chance. It will be long before they have another such chance, and I now make all such employers an offer. I will bet a fifty-cent summer hat with each of them that there is more profit in a job done by three-dollar men than there is in the same job done by one-dollar men, other things being equal. Low wages meant a low grade of workmen, and that means a high first cost of product.

"Some machinists when they speak of a good workman mean a man who is fine, close and accurate. This is not correct half the time. There are just as good men working on rough portable engines as you can find in any shop. They are skillful men. But put them into a shop building tools and they are gone. They are out of place there. In the same way the tool man ain't worth his salt on portable engines. He accomplishes nothing, and is at work all the time. Some folks think that a job cannot be done too well. Nonsense. There is more work done too well than too bad. It is no trouble to contract for good work and get it; but it is hard to get rough work properly done. Some one has said that dirt is simply matter misplaced, and I say that bad work is simply labor misplaced. If I saw a man painting a sewing machine shuttle with coal tar I would say he was botching the job, and if I saw him putting a crocus finish on a hand-car crank I would say the same thing.

"A skilled workman is one understanding the tricks and arts of the trade. If he has the judgment and common sense which tell him how and where to apply his skill, he is a good workman. If he does not know how and where to apply his skill he is not a good and valuable workman. There are more bad skillful workmen than good ones, and the thing must be equalized by supervision. The foreman is to supply the judgment and the workman the skill. A skillful foreman is generally a bad foreman, for he has judgment mixed up with his skill, and supposes that every other skilled workman has judgment also. He will give a man a job and leave him to his own devices, and if the job is badly done he will lay it to the man, because he knows that he could have done it properly himself. Such a foreman often says that it is more trouble to instruct a workman than to do it yourself. A foreman with more judgment and less skill would advise such a workman to quit the machine trade and go into the post-hole business on account of its being less abstruse."

VIEWS ON SOUTHERN PACIFIC RAILROAD—MT. SHASTA.

VIEWS ON SOUTHERN PACIFIC RAILROAD—LAKE SANTA YSABEL.

The American Brake Company, at their works at St. Louis, Mo., are beginning to build the Niederlander coupling for air brake, air signal and steam heat. They have orders for considerable of this equipment. On the freight-car coupler the air brake only is used; for special freight, express or passenger equipment all three couplers are in one head, and couple and uncouple automatically when the Master Car Builders' couplers do. They are going to manufacture them extensively and push the sale.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Defective Dry Pipes.

A vital point, and one worth observation by oil men and others whose business and desire it is to reduce to a minimum the quantity of oil used in the air pump, is the proper arrangement and fitting of the pipe which transmits dry steam from the top of the dome to the air pump.

At first glance this may seem trifling and non-consequential; but due consideration will remind one that wet steam will wash the oil off the walls of the steam cylinder of the pump the same as a foaming or too full boiler will wash the oil from the valve seats and cylinders of the locomotive, and cause groaning. Unless the dry pipe performs its function of transmitting dry steam to the air pump or steam turret, it fails in its purpose and is worthless. It would pay, therefore, to make sure that the dry pipe shall conduct dry steam only.

The pipe should reach sufficiently high up in the top of the dome and should have good threads, tightly screwed, at the connections. Many groaning air pumps might trace the cause to a defective dry pipe. Recent practice and good design have sensibly decreed that all locomotive boilers, no matter how large or ample the wagon-top, should have steam turrets to supply the air pump, injectors and other cab cocks with dry steam.

Handling Large Capacity Cars Down Heavy Grades.

Mr. "Harry" Frazer writes thus interestingly of handling large-capacity cars with air brakes down one of the steepest Western grades. He says:

"On my way back from the East, I stopped at Salt Lake to handle the 50-ton capacity coal cars of the Southern Pacific Company down the heavy grade of the Rio Grande Western. They have put in a double track on this grade. The old track, which was very straight—not more than two miles of curvature in seven miles—is now the East-bound or uphill track. The West-bound or downhill track is the new track, and they put all of the curves in that they could. This grade is seven miles long, and is 3.8 per cent. The coal tonnage down this grade has always been 490 gross tons, or thirteen 60,000-pound capacity cars.

"When these new cars of the Southern Pacific first came over here, I found that it was not safe to bring more than three of them down, with seven other cars, making ten cars in all, which about made the 490 tons, using the water brake on the engine and 80 pounds of air in the train pipe.

"While I was East, Mr. Hickey equipped an engine with two main reservoirs, giving about 46,000 cubic inches; also put on schedule "U." On the high pressure I carried 95 pounds in train pipe and 125 in main reservoir. We took eight of these cars, each one having 100,000 pounds of coal. Gross tonnage was 538 tons. Used the water brake. Put in forty-five minutes going down, about ten miles per hour, which is the order for all freight trains on this grade. The train was perfectly safe at this speed, and there was no trouble in holding it. A reduction of about 10 pounds would hold it anywhere. It took a reduction of 20 pounds to make the stop for the derailing switch, halfway down the hill. Below the derailing switch (this switch is always set for a side track up the mountain, in case of a train running away) the engineer got a little gay and let the train get running at about thirteen or fourteen miles per hour. It took a reduction of 20 pounds to slow down. The traveling engineer and myself burnt him up a bit when we got down, and told him we did not want any 'monkeywork' like that. He acknowledged he had made a mistake.

"I have recommended to Mr. Hickey that, as the winter is coming on, this engine be allowed 100 or 105 pounds in train pipe."

By-Pass Valve for Braking on Steep Grades.

The Louisville & Nashville Railroad has a bad grade—something like 4 per cent.—not far from Nashville, Tenn. Engine 999, a heavy consolidation which is working on this grade, has been equipped with by-pass pipes of 1 inch inside diameter, connecting the front and back ends of the cylinders, having a piston valve operated from the cab the same as the cylinder cocks are. When coming down this hill, if brake power is needed, the engine is reversed and the by-pass opened, fully or partly, so that part of the air can pass from one end of the cylinder to the other and graduate the resistance to the movement of the engine when reversed.

The strainers in the drain cup and triple valve largely reduce the dirt going into the triple and wearing the parts; but the dirt stops up the strainers and retards the passage of air. The hose should be hung up for these two reasons.

CORRESPONDENCE.

Prevention of Wheel Sliding on Passenger Trains.

Editor:

Those of your readers who were in the air-brake world ten or fifteen years ago remember that considerable emphasis was placed upon the instructions that stops with passenger trains should be made with *one* application of the brakes, and are sometimes surprised to hear air-brake men who should be well informed advise the use of *two* applications at all accurate stops (such as water and coal stations) and whenever the rail is slippery. As this is the time of the year that every man on engine and train should be on the alert to prevent wheel-sliding, I trust that what little hints I can throw on this subject will at least set them to thinking.

In the first place there are absolutely no advantages gained by wheel-sliding, as a sliding wheel loses about two-thirds of its full braking power. Then, too, it must be understood that trainmen are partly responsible for slid-flat wheels where they do not promptly notify the engineer by air signal, or otherwise, that wheels are sliding. No engineer can tell with certainty when only a few pairs of wheels on his train are sliding. In this connection the question is frequently asked, "Why do only one or two pairs of wheels on a car slide if the leverage is right on the car?" or else, "With the same piston travel, why do the wheels on one car slide and not on the next?"

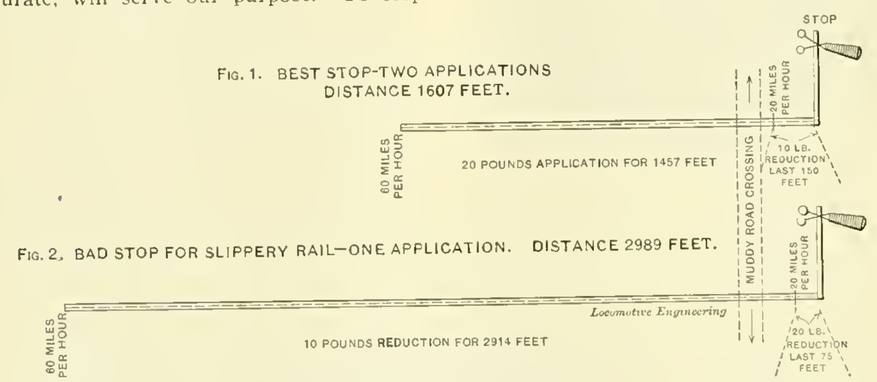
This being a fair question, it should be frankly and not evasively answered, which I will try to do. To start with, suppose that all cars when empty have exactly the same percentage of braking power on each wheel and the same piston travel. Now, in loading these cars in service, it is impossible to get exactly the same weight in every car of a train, nor even in both ends of the same car, and that car or that end having the least weight is the most likely to slide.

How can we overcome this tendency? Must we request some of the passengers in the ladies' car to ride in the smoker? or that the express messenger and train baggageman who happen to travel in the same car will please keep both ends of their car equally loaded? How could they load or unload any pieces without altering the conditions for or against wheel-sliding? It is readily seen that no two cars will brake exactly alike, on account of unequal loading, also because of the tilting tendency of the trucks and the angularity of the brake beam hangers. So the engineer and the trainmen must understand that, when equal sliding occurs, it is because the brakes are holding a little too hard for *all* the wheels to stand it with the rail conditions as they are and the speed of the train as it is at the time.

All engineers know that wheels (once turning) do not slide going fast, be the rail never so slippery, but may be slid at speeds less than twenty miles per hour if brakes be applied too hard. This point has long been pretty well understood, but there is another closely allied thereto that but few men consider. That is, the distance required to stop trains from different speeds.

In the Air-Brake Association's Proceedings for 1898 some mention was made of this matter, and a diagram showing the distance required in stopping a perfectly equipped train from a speed of sixty miles per hour was given. I have drawn that chart on a larger scale and taken from it the attached table, which, while not accurate, will serve our purpose. To stop speed down to twenty miles per hour. He now releases, bringing his valve right back to lap, and then makes a second reduction of 9 or 10 pounds. This last, giving only half of a full application, requires twice 75 feet, or about 150 feet, to stop the train. He has thus stopped in 1,457 + 150, or about 1,600, feet, and his half pressure was on when the wheels were most likely to slide. If this half pressure slides them, he must use even less for his second application. Fig. 1 gives a diagram of the stop he has made, and shows a muddy road crossing at about the point where he releases for his second application.

Fig. 2 shows how one long application works. The engineer begins 'way back and applies about 10 pounds, or half pressure. The train runs twice 1,457, or 2,914, feet before it gets down to twenty miles an hour. Then he is so close that he must only can't release but has to "give her" the other 10 pounds, which stops in 75 feet, *if they don't slide*, which they probably do. It has taken him 2,914 + 75, or 2,989, feet to stop, or nearly twice as far as the other man, and the train crew are



RELATIVE LENGTH OF STOPS MADE WITH INITIAL REDUCTION OF 20 AND 10 POUNDS. SPEED 60 MILES PER HOUR.

a train going at a given speed will require the same force by one engineer as by another, but one man may brake hard and stop quickly, as per this table, and another man may use half braking power and run about twice as far. So let us take these two cases and figure them out according to this table:

Table showing approximate distances required for reducing speed or stopping after the brakes are fully applied:

From a Speed per Hour of—	Distance Required to Reduce Speed to following Speed per Hour—					
	Stop 0	10 M.P.H.	20 M.P.H.	30 M.P.H.	40 M.P.H.	50 M.P.H.
	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
10 miles......	30					
20 miles......	75	45				
30 miles......	175	145	100			
40 miles......	350	320	275	175		
50 miles......	790	760	715	615	440	
60 miles......	1532	1502	1457	1357	1182	742

The first man, going sixty miles per hour on a fast train, runs in close to a station, and when he shuts off, whether he uses sand or not, applies the brakes fully, making an 18 or 20-pound reduction. Thus he runs 1,457 feet and has his mean enough to tell him that he has slid some wheels. So next stop he begins yet farther back, and lighter at first, and slides them again. He then asks, "How far back do you want me to shut off? I am losing time now." E. W. PRATT,

Gen. A.-B. Insp., C. & N. W. Ry.

Chicago, Ill.

Strange Running of a Crippled Pump.

Editor:

I had a New York No. 2 pump which made air for seven coaches, and only one piston rod working. The engineer did not cut out on account of air. He made his trip to his terminal as usual, and had all the air he wanted. I will try and explain the trouble.

The steam piston head pulled off, and the 10-inch air piston and rod got fast at top end of stroke, or top of pump, and the steam piston kept operating the other cylinder.

When the engine came in the roundhouse the engineer said: "I think we have struck a good thing. My pump is running and only one piston rod moving." I took the top head off and started the pump, and only the small piston traveled. I took hold of the other piston and pulled it out; then I saw where the trouble was. It does not seem reasonable to think it would run. I thought the steam would pass through the hole in the head and choke it down; but it did not do it.

D. STEVENSON.

Murphysboro, Ill.

Triple Piston Rings.

Editor:

If the leakage in triple piston rings is caused by the cylinder not being round, is not the leakage aggravated by springing the rings into the groove? Cast brass rings as small as triple piston rings cannot be sprung into place without making a kink in the ring directly opposite the cut. The ring loses its contour by the springing-open process, and never recovers it. It does seem strange that a round hole cannot be produced except by the emery-wheel process. I believe that properly constructed reamers will make a hole round, when the work is done in a *good* lathe.

I think that better results could be had if we made the packing ring of drawn brass wire, square in section. Roll the rings to proper size, braze the ends together, put them on an arbor, face the sides the proper thickness (do no work to the inside) then put them on a concentric arbor, in quantities, with the brazed joints all one way, or that the thin part of the ring will be cut at the brazing. Instead of springing the ring into position, have a follower-plate on the piston, so that the ring may not be disturbed by putting it in place.

In regard to that piston ring grinding jig, as we understand it, I see no evidence that the ring turns in the cylinder at the same time the piston does, there being a device on the jig to keep the piston moving around during the back and forth movement. Again, if the ring is taken out to be cleaned after the grinding, is it any better when put back?

If, as is quoted, there are heating pipes to be put in the cabs on engines having the Wootten firebox, why could not the air pump exhaust be utilized for heating purposes? W. DE SANNO.

Kern City, Cal.

[The manufacturer first places the packing ring in the piston groove made to receive it, then the piston is placed in a press where the groove is closed neatly to the ring. As the ring has been previously fitted to the cylinder in which it is to work, the grinding-in process alone remains. The piston and ring are now placed in the body of the triple, which is held fast and is ground in with oil, no grinding material being used. When the bearing parts are perfectly burnished, the parts are cleaned, freshly oiled and tested; but the ring is never removed after once being placed in the groove. The plan suggested would seem clumsy and not nearly as efficient as the present one, which is very satisfactory, indeed.—Ed.]

Testing Cock for Air Brakes.

Editor:

The efficiency of the air-brake equipment on the locomotive is of very great importance, and for this reason it should be thoroughly and properly tested as often as may be necessary to maintain it at its highest.

To properly test the various valves that go to make up the brake equipment, and to determine the condition of pistons in brake cylinders and the piping, as regards leaks, etc., requires the use of test gages and the services of a man well informed in air-brake matters and the defects to which it is subject. There has been of late a growing tendency to increase the number of air gages on the engine, and to have a separate one for the signal line, driver brakes, etc.

To facilitate the work of testing the brake by the inspector, and to assist the enginemen in acquiring a knowledge of the working of the air brake, as well as to dispense with the use of any except the duplex air gage, I have designed a testing cock, which I believe will accomplish a great deal in this line.

In the sketch which I have enclosed, Fig. 1 is a cross section through the body and plug cock; Fig. 2 is a view of the plug cock, showing the arrangement of ports. They are so spaced and arranged that but one port can be in communication with the air gage at the same time. Fig. 3 shows the side of plug cock next to gage connection, and the long, narrow port running crosswise is in communication with the air gage in any position. *a, b, c, d,* etc., show, respectively, the main reservoir, signal line, auxiliary reservoir and driver brake connections.

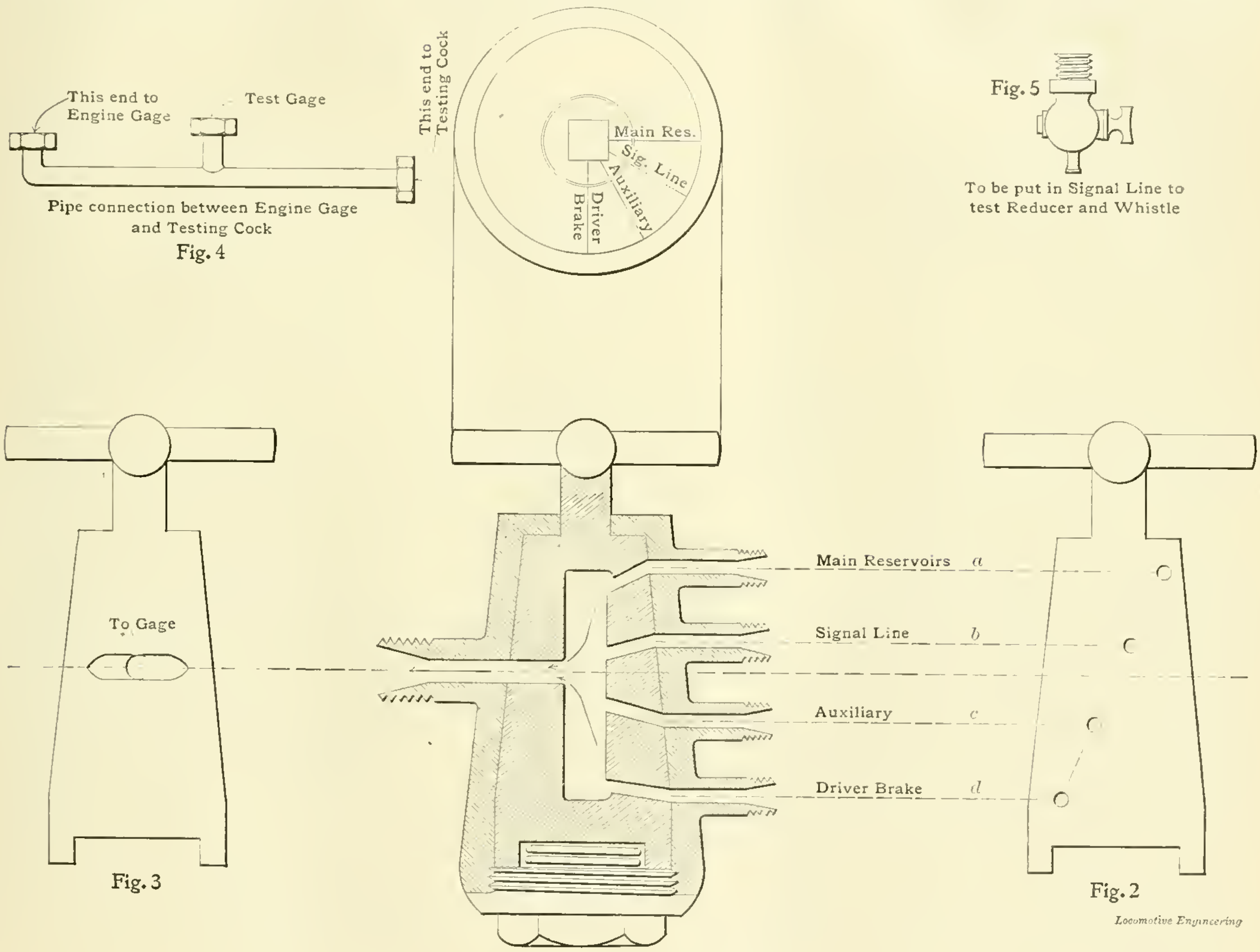


Fig. 1
TESTING COCK FOR AIR BRAKES.

The pipe shown in Fig. 4 is to connect the cock to the air gage, and it has a union on it for the inspector's test gage. The connection with the gage is made to the part that registers the main reservoir pressure.

To inspect the equipment on the locomotive, the inspector first attaches his test gage to the pipe connecting the testing cock to the engine gage—this to determine the accuracy of the engine gage.

Having the test gage properly attached, he starts the pump, making a note, of course, of the time required to pump up the pressure, that he may judge of the condition of air valves and packing in the air cylinder. During this time the main reservoir port in the testing cock is in communication with the engine and test gages. Having obtained the maximum pressure in the main reservoir, a glance at the test and engine gages will show how they compare, and whether the governor stopped the pump when the proper amount was obtained.

These points being determined, he next cuts out the main reservoir connection and switches in the signal line. The red hand on the engine gage will then register signal line pressure. In the pipe connection to the signal line port in the cock there should be a small cock, Fig. 5, such as is now placed in a hose coupling to be attached to the signal line at the end of the tender, and used by the inspector when testing the whistle, and by opening this he can test the whistle and the sensitiveness of the reducing valve.

The reducer and whistle valve tested, he turns the cock, cutting out the signal line communication, and cuts in the auxiliary reservoir.

During these tests, and before the pump

is started, the handle of the brake valve should be placed in lap position; as, if this is done, any leakage through the valve into the train pipe will be indicated by the black or train line hand of gage.

It would be well to close the cut-out cock underneath the brake valve, and reduce the volume of train pipe underneath engineer's valve, so that any leakage of main reservoir pressure into the train pipe would be more noticeable.

With the auxiliary reservoir connection to cock in communication with the gage, open the cut-out cock underneath the brake valve and place the handle in running position. This operation will enable the inspector to judge of the condition of the excess pressure and feed valves and to note the time required to charge the auxiliary reservoir.

After the train pipe and auxiliary are charged to 70, the driver brake connection should be switched into communication with the gage by turning the handle in the testing cock to the proper position, and the brakes applied. The highest pressure indicated by the gage will be that of equalization between the auxiliary and brake cylinder, and from this pressure the inspector will learn as to whether the piston travel is correct or not, and if any leakage occurs he will be able to observe that also.

All of the foregoing information regarding the equipment on the engine the inspector can obtain by the use of the testing cock without leaving the brake valve, which of course will greatly shorten the time required to inspect. Then the inspection will be more satisfactory, and unnecessary work avoided.

As a factor in the instruction of engineers and firemen, it will prove a great help; for by its aid the traveling engineer or air-brake instructor can easily illustrate a point that without it or an instruction car, would require a lengthy worded explanation.

Engineers and firemen can use it themselves to their own great advantage, and the company's also.

Other ports and connections may be made to it if desired, so as to include other parts of the equipment, or in double-heading to show the pressure in the train pipe at all times. J. P. KELLY.

New York City.

A Valuable Air-Brake Tool.

Editor:

I send you herewith a drawing of a small pocket tool, for testing triple valve stems, to determine if they are straight and if the piston head and packing ring fits squarely in its cylinder, hereby enabling the packing ring and feed groove in the cylinder bushing to do the work called upon them to do. This the packing ring is not liable to do if the stem is bent as it tilts the piston head, thus making an imperfect fit of the packing ring in the cylinder at the top and bottom. This allows the air to leak past the packing ring and enter the auxiliary, recharge it and cause the brakes to stick.

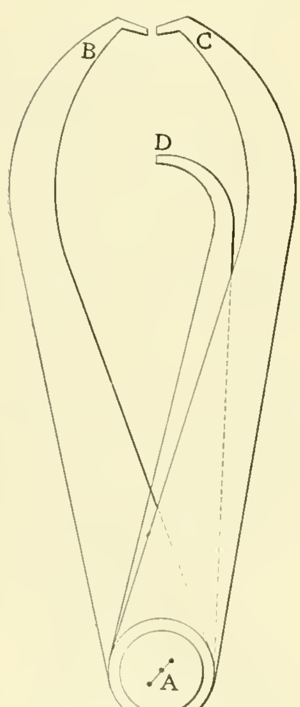


Fig. 1

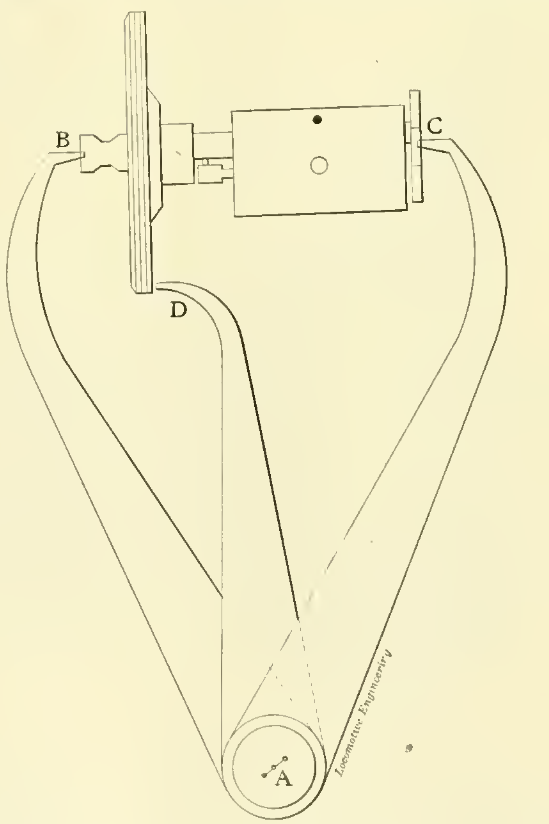


Fig. 2

In regard to the feed groove, the tilting of the piston, which is always with the top out (by observation) causes the packing ring to close partially, and sometimes entirely, the feed groove. This causes the brake to charge improperly, and if many such brakes were mixed in a train with perfect ones, they would cause the perfect ones to overcharge after every release of the brakes, and by so doing cause them to stick, causing "slid-flats," "break-in-twos" and many a kick from the engineer, of brakes dragging.

This bending of the triple piston stem is a disease of the plain triple, more common than is generally supposed, and to detect and remedy which, this tool was introduced in the West Oakland car-repairing department of the Southern Pacific Railroad.

Fig. 1 is a pair of triple leg calipers, with the two long legs 7 inches from point to hinge, and the short one 5½ inches, points *B* and *C* standing at 120 degrees to each other when closed.

Fig. 2 shows the tool in use. The piston stem and slide are pivoted between points *B* and *C*, and point *D* placed next to piston head; then by revolving the same any bend in the stem is easily detected by the piston head running out of true at point *D*. W. H. COLLINS,

A. B. Repairer, S. P. R. R.

West Oakland, Cal.

Automatic Driver Brake Release.

Editor:

In looking over the questions and answers on air-brake subjects, I notice question 78, D. B. S., Murphysboro, Ill., and I am of the opinion that he has reference to the automatic driver brake release valve manufactured by a St. Louis (Mo.) firm.

This valve is placed in the pipe which connects both driver brake cylinders. A second connection is made from the automatic driver brake release valve to the steam chest of the engine. The purpose of the automatic driver brake release valve is to release the air pressure from the driver brake when an engineer uses steam or reverses his engine. I am glad to see the air brake companies are against this, and hope that all air-brake men will be the same. OTTO BEST,

Supt. Air Brakes, N., C. & St. L. Ry.

Nashville, Tenn.

An Air Brake Prank.

Editor:

Here is a little conundrum for you, with the answer: .

A freight extra was coming west on the Southern Pacific the other day between Yuma and Los Angeles, on the Colorado desert, in Southern California. The train had stopped at a station called Mammoth Tank. The engineer was oiling around and the crew were out along the train. The fireman was also on the ground. All at once the emergency went on. The crew immediately started to look for a bursted hose, but before they could find one the brakes all released, and there was no one on the engine. What caused the application?

The answer is this: The engine was a new Schenectady mogul. The back drivers are under the firebox. This makes a double hopper ash pan, with slides on the bottom to dump the ashes. These slides are worked by air pressure taken direct from the main reservoir through a 3-way cock. The cylinder is 4 inches in diameter and about 18 inches stroke. The piston is connected to the slides. Air can be admitted to either end of the cylinder to open or close the slides. The engine has a 9½-inch pump, and F-6 brake valve. The fireman got down to dump the ash pans. The engineer had either left the brake valve on full release or in running position. If on full release, the fireman, in taking air out of reservoir, applied the emergency. If brake valve was in running position, the pressure had not yet pumped up to 80 pounds, and in taking air out of the main reservoir the same thing would occur.

H. C. FRAZER.

San Francisco, Cal.

Automatic Driver Brake Release.

Editor:

What I meant by the automatic driver brake release in my question, No. 78, November, is a valve between the triple valve and brake cylinder and a pipe leading from the steam chest to the said valve. The action of the valve is such that when the throttle valve is open the driver brakes are released. It does away with sliding of wheels and flat spots; and in double heading, when the first engine breaks off, it gives it a chance to get away. It has done it on three different occasions, and those that were not so equipped with the driver brake release got beams smashed in.

D. B. STEVENSON.

Murphysboro, Ill.

[This device was criticised in these columns about three years ago, the chief objection being that it was one of those parasites on the air brake which was possible to do more harm than good, and which fails in accomplishing much that is claimed for it.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(1) D. B. S., Murphysboro, Ill., asks:

Why would not one auxiliary reservoir and one triple valve do for engine and tender if they were made larger in proportion? A.—This plan was followed in the earlier days of the air brake, but experience demonstrated that better results were given when the driver brake and tender brake were operated from separate auxiliaries. A leak in the cylinder packing of any one, or a loose joint anywhere in the cylinder pipes would release all three brakes.

(2) P. R. L., Syracuse, N. Y., writes:

In your reply to W. L. E., in question No. 79 in December number, you say to bleed off the air brakes before setting the hand brakes on some cars left standing on a grade. Why not set the hand brakes while the air is set, and then, when the air leaks off, the hand brakes will be set good and hard? A.—The brake gear on some cars is so designed that when the air leaked off, the hand brake would be off also. This is true where the hand brakes and air work together, as on a passenger car, and some coal and freight cars. On other cars where the air and hand brakes work opposite, a weak brake chain might be broken and let train get away.

(3) W. H. R., New York, asks:

Will an air pump (on locomotive) without governor, pump pressure in main reservoir equal to that in boiler? Please explain, as some of us differ. I say it will not. A.—Yes, and even higher, if the air cylinder is sufficiently smaller than the steam cylinder. The 8-inch pump, which has 8-inch steam and 7½-inch air cylinders, will do it; but the 9½-inch pump, whose steam and air cylinders are equal in diameter, will not. Some modified forms of the locomotive pump, where air cylinders are much less in diameter than the steam, are now being made for other uses, and deliver a much higher pressure of air than the steam required to run the pump.

(4) W. D. H., San Marcial, N. M., asks:

What effect on the action of a D-5 valve would it have in making a service stop, if small taper bush in port *e* of rotary valve seat should be gone, leaving a hole about 3-16 inch in diameter? How would it affect the action of the valve, or does the size of the hole make any difference? A.—The small port *e* in the brake valve restricts to a safe limit the discharge of air from the equalizing chamber, and thereby controls the discharge of train pipe air by the equalizing piston in service application. If the bush were gone, an emergency application would be had on a short train. The large port would allow the heavy reductions and would render fine graduation impossible.

(5) W. D. H., San Marcial, N. M., writes:

Am having trouble with equalizing piston in a D-5 brake valve sticking up when coupled to more than fifteen cars; with less than this number or with light engine valve works fine. Have cleaned valve thoroughly and examined closely for leaks both in pipe connections and in gaskets in valve and have changed pistons, but all work alike. What is it, please? A.—The longer discharge, due to longer train, may be mistaken for a piston sticking up. Should the piston actually remain up, however, and empty the train pipe with a long train, and not with a short train, there is surely a leak of equalizing chamber pressure. Look at the equalizing piston ring, drum connections, gaskets, gage connection to black hand and tube in the gage. Test for leaks with soap suds (except packing ring). Is bush in part *e* removed or is hole enlarged? The enlarged port would manifest itself more on a long train than on a short one.

(6) H. L. H., Pensacola, Fla., writes:

What is the cause of one triple on an engine tender releasing itself on lap, after being applied, while the one on the engine does not? The rotary valve was tight, the gasket between feed-valve attachment and the body of valve in good condition, and no leaks appeared around auxiliary reservoir under tender. Please explain. A.—If the brake whistles off through the triple valve, the pressure in the train pipe must be increased or the pressure in the auxiliary reservoir be decreased. That part of it is beyond doubt. If main reservoir air does not get into the train pipe there is another place to look at; that is, the driver brake, which may have a higher cylinder pressure, due to shorter piston travel and consequent higher auxiliary reservoir pressure. This pressure may leak back through the piston packing ring and leather gasket into the train pipe. The auxiliary pressure of the tender brake may be decreased by a slight and unnoticeable leak through the graduating valve and slide valve into either the brake cylinder or atmosphere.

(7) W. H. R., New York, writes:

A reduction of 10 pounds from 70 pounds train line will give 25 pounds on the brake cylinder. A reduction of 10 pounds from 60 pounds train line will give 25 pounds on the brake cylinder. This is a question in the air-brake car, and is explained as folows: The auxiliary is two and one-half times larger than the brake cylinder, consequently pressure in the brake cylinder will be two and one-half times 10 pounds, or 25 pounds in each cylinder. Now, I do know that in practice with 70 pounds train line pressure, a reduction of 8 to 12 pounds would handle the train nicely. But with the train line set at about 64 pounds, it took from 12 to 18 pounds to stop the train. Please give us some information on this point. A.—Twenty-five pounds of pressure in a brake cylinder will hold just as much, of course, no matter whether it comes from an auxiliary reservoir charged to 76 pounds or 60 pounds. But if the train pipe should happen to be charged higher than the auxiliaries, as is likely to be the case on a close second application, more and useless pressure would be drawn from the train pipe, and no more pressure, and possibly not as much, would leave the auxiliaries and go to the brake cylinder than in the case where train pipe and auxiliary pressures were equal and each pound counted in the reduction. Probably other affecting conditions have not been observed.

Schenectady Ten-Wheeler for Southern Railway.

The annexed engraving illustrates one of a group of heavy passenger ten-wheel engines recently built by the Schenectady Locomotive Works for the Southern Railway. The engines weigh, in working order, 153,500 pounds, of which 113,000 pounds rest upon the drivers. The rigid wheel-base is 14 feet 7 inches, the total wheel-base being 25 feet 8 inches.

The cylinders are 20 x 26 inches; the piston is 6¾ inches thick, and the piston rod is 3¾ inches diameter. Cast-iron rings compose the packing with the Peacock break joint. American balanced valves are used, with 1-inch lap and 5½ inches travel. The driving wheels are 70 inches diameter outside of tires and have cast-steel centers. The driving boxes are of steeled cast iron. The driving wheel journals are 8½ x 11 inches. The main crank pin journals are 7½ x 4½. The others are 6½ x 6½ inches, and the side-rod pins 5 x 4 inches.

The boiler is of the extended wagon-top style, 62 inches diameter at smallest ring, and provides 2,328.61 square feet of heating surface, 2,138.43 square feet being in the tubes, 27.04 in the water tubes, and 163.14 in the firebox. There are 290 2-inch tubes, 14 feet 2 inches long. The firebox is 75¼ inches deep in front and 61 inches in the back. The crown-sheet is supported by radial stays, 1⅛ inches thick.

Among the equipment are Monitor injectors, United States packing, Westinghouse-American combined brakes on drivers, tender and for train; 9½-inch air pump, Westinghouse air signal, Coales safety valves, McIntosh blow-off cock, made by Jerome; Leach sanding device, Janney couplers and steam-heating apparatus.

The engine has about 25,000 pounds tractive power, and a ratio of 6 between adhesion and tractive power.

Eccentric Strap Fittings.

On the Erie Railway brass bearings are used in the eccentric straps, consisting of a brass hoop 2⅞ inches wide and ½ inch thick, which runs in a groove cut in the cam and a similar one in the strap. The groove in the strap is much the same as that used in the ordinary method. It is about 3-16 inch deep. A similar groove is turned out of the cam. The brass hoop, which is cut into three pieces, fits in the grooves, half in the cam and half in the strap. A number of oil holes are drilled through the brass hoop so oil can work through to the bearing on the cam. Of course, with this arrangement all the wear comes on the brass, and the cam and strap retain their original shape and size. Steel straps and cams are used with these hoops. This style of eccentric bearings gives very good service, as they do not run hot and last very well if the brass is not too soft. When the brass hoop wears, another one is easily substituted. On the Monon Route, where some trouble was experienced with hot and broken straps and cams, the bearing in the strap has been changed to babbitt, or, as it is more correctly known, "bearing metal," composed of 5 to 1 lead and antimony. The strap is bored out ¼ inch deeper than usual for the cast-iron bearing, a few shallow ¾-inch holes drilled in the strap to anchor the bearing metal. The groove is then poured full and bored out to fit the cam. This bearing wears a long time. We saw some of them on heavy engines that had run over a year with no trouble from heating and very little wear. About all the engines on the road have this style of eccentric strap bearings, with the best of results.

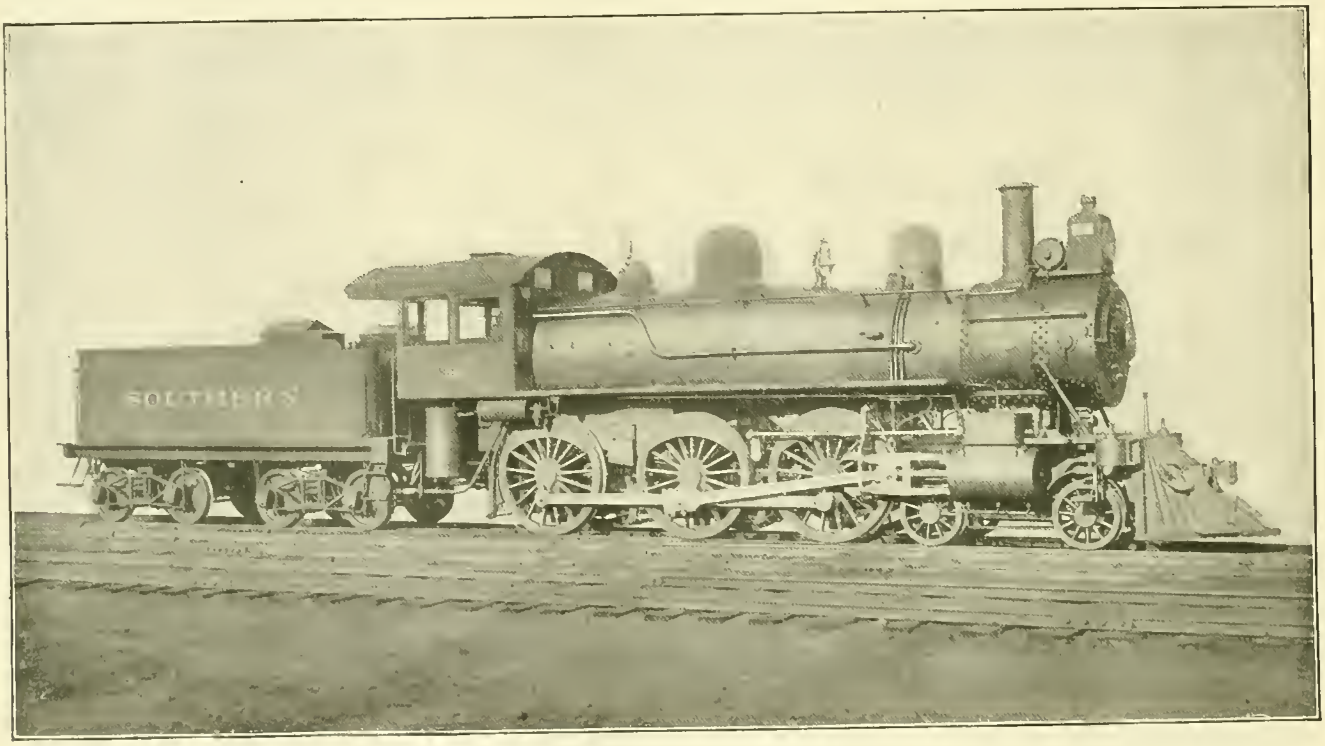
On a Michigan railroad, where chronic hot eccentric straps were a regular thing, the width of the bearing on the cam was increased from 1¾ to 2½ inches some four years ago, since which time hot eccentrics have been almost unknown. These wide bearings last as long as any part of the link motion. Both cams and straps are ordinary cast iron of a standard width and diameter for 16, 17 and 18-inch engines, so that one type of strap fits all three classes. A standard pattern of cam is also used with the same finished size outside, and bored out properly for the size of axle and throw of eccentric.

Bronze eccentric straps are extensively used. They are very strong, run cool and last fairly well. The first cost of a brass casting as against cast iron is prohibitive in many places.

After all, a generous bearing surface is of more value than special metals.

Straps should be made reversible instead of rights and lefts, and the oil recess should be in both sides. It can be used for a cellar when it comes at the bottom, or an oil cup at the top.

Provision should be made for attaching a cup similar to the ones used on crank



SCHENECTADY TEN-WHEELER FOR SOUTHERN RAILWAY.

pin bearings. There is no good reason why this cup cannot be made a part of the strap and fitted with a feeder that can be adjusted just the same as main rod cups.

Pneumatic Coaling and Sanding Station at Oakdale, Tenn., on C., N. O. & T. P. Ry.

I herewith hand you a blueprint and description of the above, which perhaps will be of interest to you and worthy of illustration in your valuable journal.

The pneumatic coaling and sanding station here shown was designed and built at the company's shop, at Chattanooga, Tenn. It is located at an important engine terminal, and at a point where yard space is at a premium, and could not be spared for the long approach necessary to an elevated coal chute.

The trestle supporting the hoist and sand reservoir spans the turntable track, and is constructed of 75-pound steel rails forming the uprights, and parallel channels forming the track on which the hoist is mounted.

The hoist is telescopic in its construction, mounted on frictionless, self-oiling wheels, and is calculated to raise 7,000 pounds at 60 pounds per square inch pressure. The pressure carried is from 90 to 100 pounds per square inch.

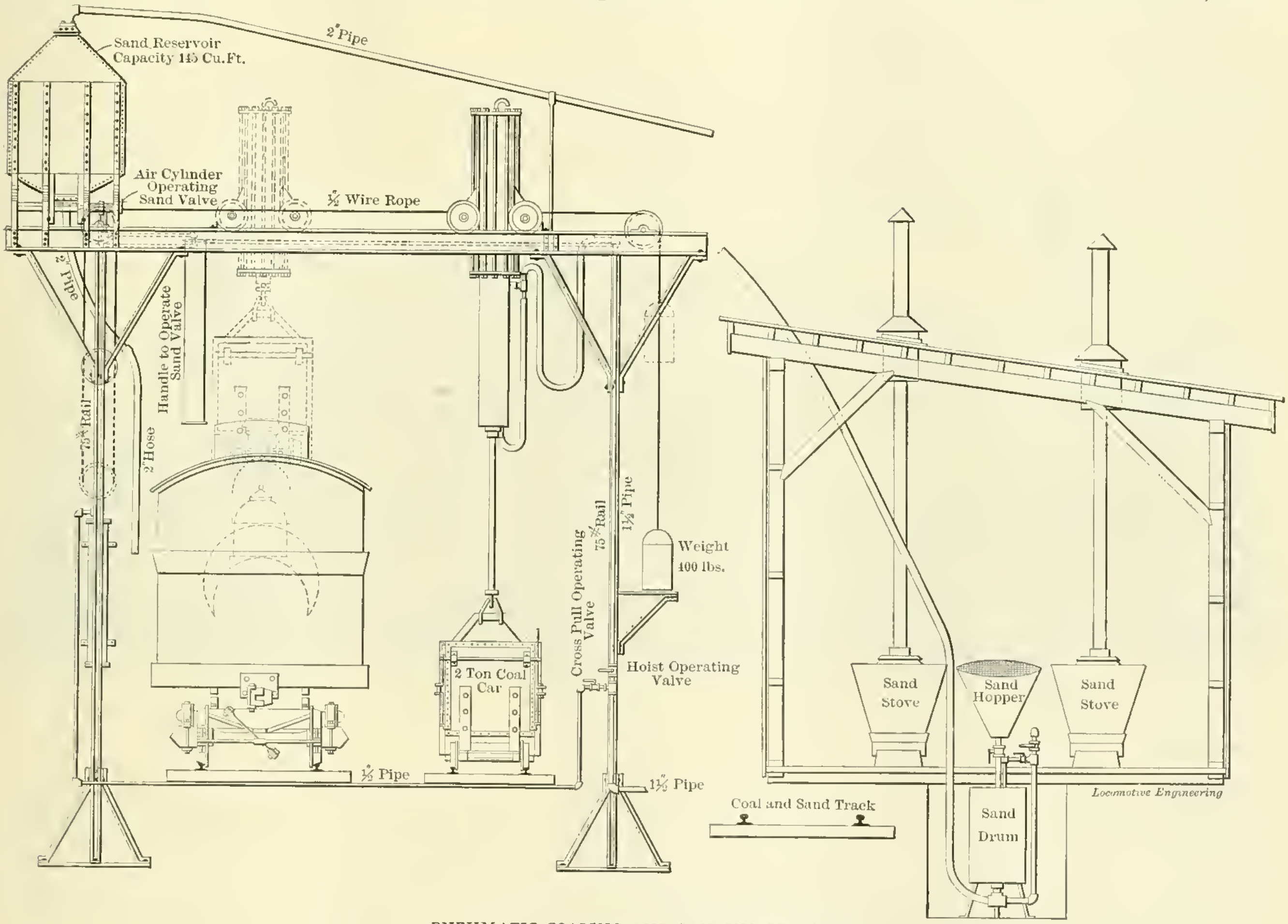
The six 2-ton buggies, which are also equipped with frictionless, self-oiling wheels, are located on narrow gage track between the unloading track and turntable track. When filled, they are raised and pulled transversely until central with the tender to be coaled, when, by displacing a trigger, the buggies open and discharge the coal, the hoist and buggy then return to their normal position, central with the coal buggy track by gravity, a weight being the means employed. The valves to both the hoist and transverse cylinder are operated from the same point. The two tons of coal can be raised, discharged and buggy returned to the track in one minute.

The sand, after being dried, passes through the screening hopper into a drum sunk into the ground. When this is charged the sand is blown through a 2-inch pipe to the sand reservoir on the trestle, to the left, which has a storage capacity of 145 cubic feet. From this reservoir the sand is discharged into the locomotive sand boxes by gravity, through a 2-inch pipe and hose; the valve in bottom of reservoir being opened and closed by a small air cylinder, which is operated by the person sanding the engine.

The air pressure is supplied by two Westinghouse air pumps (compounded) pumping into a large storage reservoir; steam being furnished from stationary boiler, which was previously located for use of pumping station and electric-light plant.

V. B. Lang,

Chattanooga, Tenn. Master Mechanic.



PNEUMATIC COALING AND SANDING STATION.

Dynamometer Cars to Establish Tonnage Rating.

At the present time when the tonnage rating of locomotives is being introduced so generally on all railroads, a correct method of arriving at the exact hauling power of each locomotive is absolutely necessary to arrange the rating with justice to the machinery.

Dynamometer cars with recording apparatus are valuable, but they are not plenty enough so that small roads can get any use of them.

If more information as to their cost, complete, and the expense of operating was at the service of railroads, we believe that more of them would see their way clear to use them.

What does one of these cars cost? Will some of our readers contribute a statement of the cost of the various items that go to make up a complete car?

Five heavy locomotives recently built at the Rogers Locomotive Works for Southern roads have cast-steel frames of a form designed by Mr. R. M. Galbraith, master mechanic of the St. Louis Southwestern. There are a great many of these frames now in use, and not a single breakage has been recorded. Mr. Galbraith is working on the design of a cast-steel cylinder and saddle.

Baldwin Compound for the Erie.

Our illustration shows the Atlantic type of compound Vauclain express passenger engine recently turned out from the Baldwin Locomotive Works for the Erie Railroad. The cylinders are 13 and 22 by 26 inches, and the drivers are 76 inches in diameter. Total wheel base is 24 feet 9 inches, and the driving wheel base 6 feet 7 inches. In working order the engine weighs 148,270 pounds, of which 77,920 are on the drivers. The boiler is 61 inches in diameter at the smallest ring and has 269 2-inch tubes 15 feet long. The firebox, which is of the Wootten type, is 96 inches by 96 inches. There are 2,269.8 square feet of heating surface, of which 2101 feet are in the tubes and 168.8 in the firebox.

BALDWIN COMPOUND FOR THE ERIE.

A Hungarian Plans a Nice Journey.

Many novel propositions are received by the Government officials in Washington, but one presented to Secretary Hitchcock by a citizen of Hungary eclipses all others in this line. The Hungarian evidently wishes to make a tour of the United States at the expense of the Government, and at the same time gather data for a book, giving his impressions of America. He has requested that transportation be furnished him, his wife, five children and two servants from his home in Hungary to the United States and return, so as to enable him to inspect the unoccupied lands of this country for the purpose of colonizing a number of his countrymen here. This trip would involve a tour of Idaho, Wyoming, Colorado, Kansas, Montana, North and South Dakota, and, in fact, almost every State in the Union. The Hungarian expects this Government to defray all the expenses of his family, in addition to which he is to receive remuneration for his trouble. No reply has yet been made to this proposition, but the Hungarian will be informed there are too many native Americans who would gladly take a trip of this character at the expense of the Government, without going abroad to bestow favors of this kind.

Colors of Heated Steel.

A short but interesting paper by Maunsel White and F. W. Taylor, Bethlehem, Pa., says:

There is, perhaps, nothing more indefinite in the industrial treatment of steel than the so-called color temperatures, and as they are daily used by thousands of steel workers, it would seem that a few notes on the subject would prove of general interest.

After many tests with the Le Chatelier pyrometer and different skilled observers working in all kinds of intensity of light, we have adopted the following nomenclature of color scale with the corresponding determined values in degrees Fahr. as best suited to the ordinary conditions met with in the majority of smith shops:

	Degrees.
Dark blood red, black red	990
Dark red, blood red, low red	1,050
Dark cherry red	1,175
Medium cherry red	1,250
Cherry, full red	1,375
Light cherry, bright cherry, scaling heat,* light red	1,550
Salmon, orange, free scaling heat*	1,650
Light salmon, light orange	1,725
Yellow	1,825
Light yellow	1,975
White	2,200

With the advancing knowledge of, and interest in, the heat treatment of steel, the foregoing notes, it is hoped, may prove of some value to those engaged in the handling of steel at various temperatures, and lead to further and wider discussion of the subject, with a view to the better understanding and more accurate knowledge of the correct temperatures. The importance of knowing with close approximation the temperatures used in the treatment of steel cannot be over-estimated, as it holds out the surest promise of success in obtaining desired results.

*Heat at which scale forms and adheres, *i. e.*, does not fall away from the piece when allowed to cool in air.

Fast Runs With Brooks Engines.

Believing that our readers will be interested in a report based on official figures of a fast run recently made on the Lake Shore & Michigan Southern Railway, we take pleasure in submitting the following:

When about a month ago the Brooks Locomotive Works furnished to the Lake Shore & Michigan Southern Railway Company eleven heavy ten-wheeled passenger locomotives of new design, it was anticipated both by the railway company and the builders that some notable performances would result in the way of increased speed for their heavy passenger trains. That a beginning has been made in this direction is evidenced by a run made November 22, 1899, by train No. 3, fast mail limited from Buffalo to Cleveland, a distance of 183 miles. This train was made up of engine No. 601, one of the new locomotives referred to, five postal cars, two sleepers, one combination car and one coach. We are unable to ascertain the exact weight of this train, but from such data as we have at hand we believe a fair estimate to be approximately 675 tons. Train No. 3 is scheduled to leave Buffalo at 6:25 P. M., Central time, and to reach Cleveland at 10:50 P. M., Central time. On this occasion she pulled out of Buffalo at 7:24 P. M., 59 minutes late, and reached Cleveland promptly on schedule time, having accomplished the run, exclusive of three stops, at Dunkirk, Erie and Ashtabula, respectively in 3 hours and 10 minutes, or at the rate of 58 miles per hour.

We append a copy of the official log of the run, as follows:

EASTERN TIME.

	Leave P. M.	Arrive P. M.		Leave P. M.	Arrive P. M.
Buffalo	7:24	....	Swanville	9:19	....
Buffalo Creek	7:31	....	Girard	9:25	....
West Seneca	7:35	....	Springfield	9:29	....
Athol Springs	7:39	....	Conneaut	9:35	....
Lake View	7:44	....	Tower 2	9:40	....
Aogola	7:51	....	Kingsville	9:43	....
Farnham	7:55	....	Ashtabula	9:53	9:48
Silver Creek	7:59	....	Coal Chutes	9:57	....
Dunkirk	8:15	8 10	Geneva	10:03	....
Van Buren	8:21	....	Madison	10:08	....
Brocton Jc.	8:26	....	Perry	10:13	....
Westfield	8:34	....	Painesville	10:18	....
Ripley Cross'g	8:36	....	Mentor	10:23	....
Ripley	8:42	....	Willoughby	10:27	....
North East	8:50	....	Wickliffe	10:31	....
Harbor Creek	8:50	....	Nottingham	10:33	....
P. & E. Cross'g	9:01	....	Collingwood	10:35	....
Erie	9:10	9:04	Glenville	10:38	....
Dock Junc.	9:13	....	Cleveland	....	10:50

From this official train report it is evident that, exclusive of stops, the entire distance of 183 miles was made at an average speed of 58 miles an hour. The distance from Dunkirk to Cleveland, 143 miles, was made in 144 minutes, and from Erie to Cleveland, 95 miles, at the rate of a mile a minute. From Erie to Ashtabula the train made an average speed of 65 miles per hour, and from Painesville to Mentor, 7 miles, the speed was at the rate of 83.7 miles per hour.

A recapitulation of the run is shown in the following table:

FROM BUFFALO—REGULAR RUN, TRAIN NO. 3.

To	Mi.	Schedule Time. H. M.	Speed per Hour. Mi.	Time Made. H. M.	Speed per Hour. Mi.	Stops Not Included.	Gain in Minutes.	Gain in Miles per Hour.
Dunkirk	40	0 52	46	0 46	52	Three water stops and two crossing stops, aggregating 16 minutes.	6	6
Erie	88	1 57	45	1 35	55		22	10
Ashtabula	129	2 56	46½	2 13	58		43	11½
Cleveland	183	4 10	44	3 10	58		60	14
Dunkirk to Erie	48	1 05	44	0 49	58¾		16	14¾
Erie to Ashtabula	41	0 50	49	0 38	65		12	15
Ashtabula to Cleveland	54	1 24	38½	0 57	57		27	18½

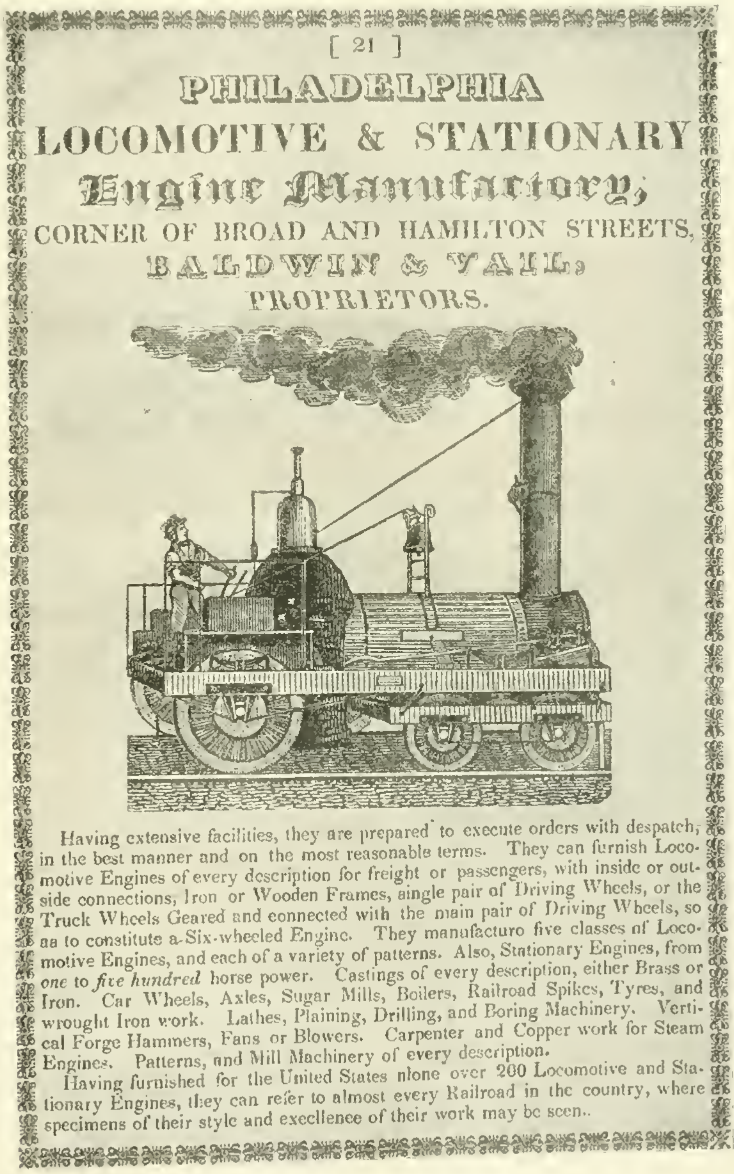
P. S.—This run was made against a heavy side wind.

The Falls Hollow Staybolt Company are in receipt of an order from the Baldwin Locomotive Works for 3,000 feet of Safety hollow staybolt iron, 1 1-16 inches outside diameter, with 5-16-inch hole, for use in the locomotives that company are building for the Atchison, Topeka & Santa Fe Railway. Also a large order for Safety hollow steel bolts from the Neafie & Levy Ship and Engine Building Company.

Gulf Between Theory and Practice.

In a paper presented to the American Society of Mechanical Engineers the following curious incident is related:

"The gulf between the work of the schools and the shops has sometimes been called a difference between theory and practice, but the real variance in educational attempts is between men—between the mechanic and the schoolman, between the machinist and the engineer. Brave attempts have been made to bring the two together, but with partial success only. In one of our most prominent and practical engineering schools a professor had designed a commutator which required sections cut from a metal ring. The professor ordered two rings, so that a piece from the second could be used to make up for the loss in cutting up the first. The machinist said, 'Let me make one ring only, somewhat larger than you want, cut it up, and then turn it to the exact size, and thus save the cost of the second ring.' 'No,' answered the professor; 'I am doing the engineering, I want you to do the work.' I state this actual occurrence as one of many illustrations which might be given to show that the two have not yet joined work even in the technical schools. It is not always an easy matter to secure this necessary union, and even where it seems to be attained it is not always complete. It can be secured by having both vital parts in one and the same man."



A PAGE FROM THE PHILADELPHIA DIRECTORY OF 1842.

We have received a very handsome illustrated calendar from the Ashton Valve Company, of Boston, Mass. It contains a picture of the summer girl, whose appearance is refreshing to the eyes during these winter months. Parties looking for an artistic calendar should send to the Ashton Valve Company for it. It is freely distributed to the friends of the Ashton Valve Company, and any engineer can obtain one upon application. To others there is a nominal charge made of ten cents per copy.

Instructions to Young Firemen.

On one of the Western railroads the following bulletin letter was sent to the newly employed men as an advisory letter. It contains a good many valuable pointers, and is written in a concise, good-natured way, which makes it an acceptable document:

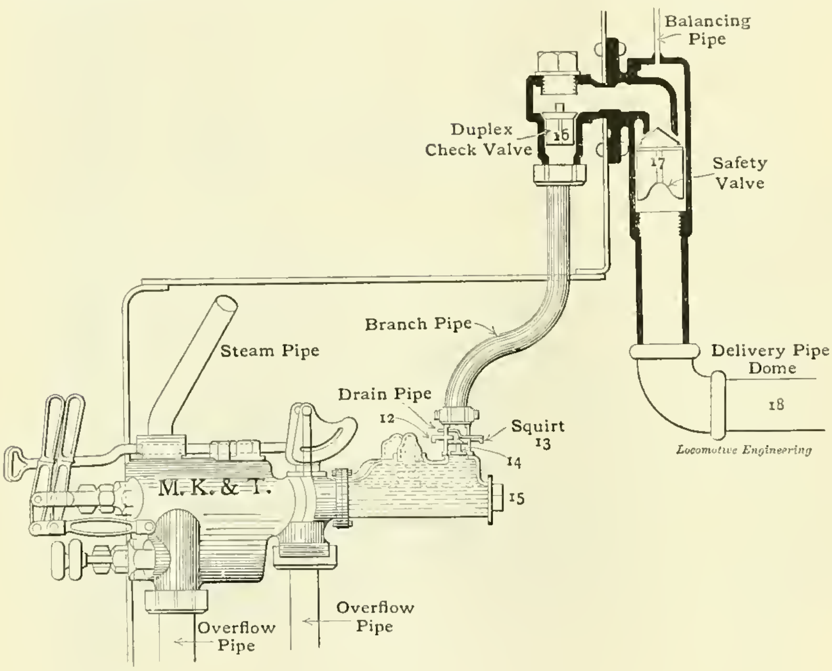
To Firemen Entering the Service—A Few Things You Should Know and a Few of Many Things You Must Learn:

You are entering upon a profession that is one of the greatest in the world; that is, of transportation. It requires bright, alert men from bottom to top, and you are now among them; this should be a source of satisfaction and arouse your ambition.

Your first experience on an engine will be disappointing, but every engineer, fireman, and many of those who are in higher positions, have passed through the same trials as you will meet, and after you are accustomed to your duties they will become easier to you.

You are required to be "within call" at all times except when excused from duty by the roundhouse foreman; if obliged to go where the caller cannot readily find you, leave word with someone where you live, advising where you may be found. To be "missing" when wanted is a matter of discipline and may have grave consequences. Keep posted on when you will "get out;" it is convenient and will save trouble.

When called for service, respond quickly, sign the caller's book, go at once to the roundhouse, register your name on registry book after the engineer's, go to your engine, and if at night, light the gage lamp, examine the tender and see if it is full of water and inform the engineer if it is full or otherwise. Examine the ash-pan, see if it is clean and drop grate in proper place, the leg well forward. See that the fire is in good condition so as to be got readily into shape to pull a train. Fire lightly one scoopful of coal evenly spread over the grates, coal broken to size of a large egg; quantities of black smoke from the stack indicate a heavy fire and poor firing. Keep the deck swept clean and sprinkle with water first to avoid dust. Wipe the oil cans on boiler head as often as they show dust, and fill them promptly after the engineer has used them. Keep the supply oil cans in oil box clean, also the oil box. A fireman with a dirty seat box wears a dirty shirt. After making a trip, on your arrival on roundhouse tracks, before going home, draw the supplies of oil, waste and other needful things, presenting an oil ticket to the oil house man. Fill the engine oilers, lubricator (if you understand it), gage lamps, blizzard lamps and headlight; put in their proper places flags and blizzard lamps. Trim the red and white lanterns; all engines carry them lit at night. The requirements are that an engine must be left by you so that if another is called to go out in the engine it will be all ready; others will do the same for you.



PECULIAR INJECTOR CONNECTION.

Then go to the roundhouse and register your name on the registry book and know that the caller has your name and residence on his book, so he can find you when wanted. After having your rest go to the roundhouse and clean your engine (ask some of the older firemen to show you what is needed and how to do it). Do it well; it is worth while. Some firemen have failed to become engineers because it was rightly judged that they, being careless in cleaning, would be careless engineers if promoted.

Fire with economy; the coal you save increases the earnings of the road. You had rather work for a prosperous company than a bankrupt one; it is more creditable. You know that when a road goes in the hands of a receiver, it is said to be by mismanagement. If you do not manage well, you are an aid to bankruptcy.

Read the special orders on the bulletin boards in roundhouses before going out. They are for you as well as for the engineer. Read the train orders carefully when the engineer hands them to you; it may save an accident. Make yourself familiar with all general and special rules in time-table, particularly so with proper reading of train orders.

The engine is in charge of the engineer, and you are to obey his directions cheerfully, and he will treat you right. You should assist as much as possible when he has work to do on engines. You will thus learn how yourself.

Report to a company's watch inspector every week for comparison of time. Your watch is one of your best friends; treat it well.

The traveling engineer will ride with you from time to time; show him a clean engine and that you are skilled in all your duties. He makes a record of what he sees. Let your record be No. 1; it pleases the officials to whom it goes, and is never lost.

You will find men in the employ of the company who will tell you in a loud voice that they have brought so-and-so to time, meaning some superior officer. Don't believe them. They are men of low standing, and are in fear of losing their positions for misconduct. You will find they wear dirty clothes and are slovenly in appearance, and their engines look like themselves as near as they dare let them. Keep clear of them as associates.

Dress warmly; you will be exposed to strong drafts, and by dressing suitably you will escape sickness. Be careful in drinking water along the road; much of it is unfit for drinking.

Examine the ash-pan frequently to see if it is not filling up. If any ashes are found, clean it out at once. Before going under the engine, always tell the engineer. Clean out the front end at the cinder pits located at certain water tanks. Look back frequently and see if all the train is coming. Be vigilant in watching signals; lives and property depend on you.

The first six months' employment is on probation; if services, character and associations are not satisfactory, dismissal will follow. At the end of that period, you will be examined by district master mechanic or traveling engineer on the knowledge you have acquired of your duties, and a yearly progressive examination will follow.

Study books treating on your profession and strive to be well informed on general railroad affairs. Especially examine the construction of engines, tenders, freight cars and coaches. Carry a pocket rule and use it; it is a book in itself. Be polite to the roundhouse foreman; he will appreciate it. But he is a busy man and may not have time to pay you as much attention as you would like.

Keep good company, because it is right. Respect yourself, and you will not lack for respect from others. There are many other things you must learn, but this may be a hint for you that will help.

High Firebox Doors.

To go back into ancient history, wood burners needed high firebox doors, so the fuel could be filled in clear up to the crown sheet. When these engines were changed to coal burners the doors were found much too high for convenient or economical firing, and the first time that any extensive repairs were made in the firebox the door opening was lowered by putting in a new one.

To fire coal easily, and at the same time economically, the door should not be much higher than a man's knee. This allows the scoopful of coal to be swung from the tender deck to the door opening and delivered on the fire at the proper place with a continuous swinging movement which is to the best advantage, as well as a saving of strength on the part of the fireman. If the door is too high above the deck, this cannot be done, especially with a deep firebox which extends below the engine frame. If an arch is used, some of the coal is liable to be thrown on top of it.

Engines that are so arranged that an unnecessary amount of manual labor and strength are used in handling the coal are not economical, for a tired man cannot do as good work as one whose strength has been saved by convenient arrangements. To fire economically the fireman should be able to see the surface of the fire each time he swings the door open, so as to judge just where the next scoop of coal should go.

We are led to these remarks by seeing new engines of large size, intended to handle heavy trains, which, of course, burn considerable more coal than ordinary-sized engines, with the fireman's deck a long ways below the door, so that every pound of coal has to be raised up 24 to 30 inches to swing it through the door. Of course, these engines cannot have the door placed at a lower point, but the deck on which the fireman stands can be raised till it comes at exactly the right height for convenient and economical work. The Brooks Locomotive Works use this plan. On some of their large engines the false deck is 19 inches above the frame of both engine and tender—quite a saving on lifting coal. This, of course, takes away some of the coal space in the pit of the tender. If it were not for the need of changing tenders from one engine to another in the case of breakdowns, the water space could extend clear across under the coal and have no coal pit; let all the coal be on top of the cistern, and the deck could be the proper height for the door. This would put the heaviest part of the load at the bottom, as a cubic foot of water weighs more than a cubic foot of coal.

A fire door which is just above the surface of the fuel on the grates can be much higher than with a deep box, and still be economical. This is the case with the Wootten type, but that does not do away with lifting coal 30 to 40 inches which could be passed along on the level.

Boston & Albany Shops at West Springfield.

The West Springfield shops of the Boston & Albany are nicely located as regards room for expansion and good air and light. There are many little points of interest here, too, for the mechanic, and Master Mechanic Barnes and Foreman Beach are both very willing to show them

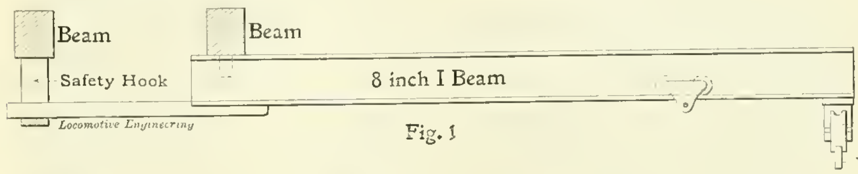


Fig. 1

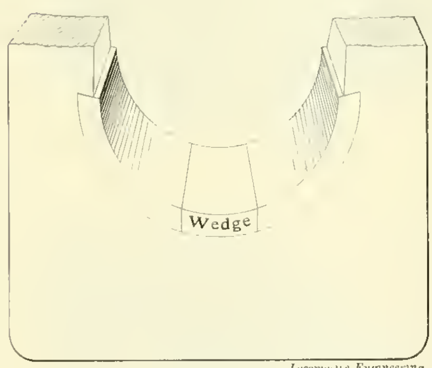


Fig. 2

to the interested visitor. Cranes are used where possible, and one in particular catches the eye of a visitor.

It is over the axle lathe, and handles the axles either from the floor in front of the lathe or at a door of the shop at the end. As this is quite a distance, and it was impossible to find a beam in stock over 20 feet long, they put an extension on the back end, as shown in Fig. 1. It is really a swinging tram, with the center at the beam shown. The extension carries the traveling trolley out to the door. The beam is of I section, and swings but little to accommodate the work. The safety hook or loop prevents the beam dropping should the bolt break.

We also ran across some of the old driving boxes built by the late Wilson Eddy. As many of the older men may remember, the brass was in three parts, the crown piece being a wedge which held the whole brass lining in place. These gave good service, and they are said to have given very little trouble from getting loose. Fig. 2 shows the idea quite clearly.

Air motors are used quite extensively, and these have been built by the foreman. They are very compact little affairs and do good work. One drives the portable valve seater; the cylinder borer is also driven by one, and small forges have their blowers run by a small air motor.

Where Trespassing on Railroads is Discouraged.

During a ramble in continental Europe, gone through three or four years ago, our chief mentioned in letters written on the spot that railroad companies in Southern Europe did not care much whether their tracks were fenced or not, because it was the duty of the owners of stock to prevent their animal property from straying upon railways or any other place where their presence was not wanted. This excited considerable interest among American railway officials, who have to pay large sums annually to grangers who induce their stock to stray upon railroads for the purpose of selling them to a party who is not a bidder but is an unwilling buyer at the very highest price.

A case happened on a French railway near Brest, that illustrates in a striking manner the difference between French and American practice in regard to the killing of stock by railroad trains. An ox belonging to a French farmer got out of an inclosed pasture and made its way through the fence protecting a railway track. The expected happened. The ox and a freight train came into contact, and a bad wreck was the result, the conductor of the train and the ox having been numbered among the dead. With us the sequel of the accident would have been that the owner of the steer would have recovered from the railroad company the price of a thoroughbred animal. The French farmer was not so fortunate. Not much. As a preliminary, a local magistrate fined the farmer 16 francs for not keeping his fence in order. Another court decided that he should pay 6,948 francs 65 centimes for the damage done to the railway track and rolling stock. Now the widow of the dead conductor has sued him for 30,000 francs for the loss of her husband. On the whole, there seems to be little encouragement given to French farmers to pasture their live stock on the right of way of a railway company.

An old locomotive cylinder which lost by accident its mate and its source of power, is used in the Union Pacific shops at Omaha to operate a ram for pushing brasses into driving boxes, and for other power purposes where a vigorous squeeze is needed. It is set horizontally in its natural position, and is very convenient to reach and to operate.

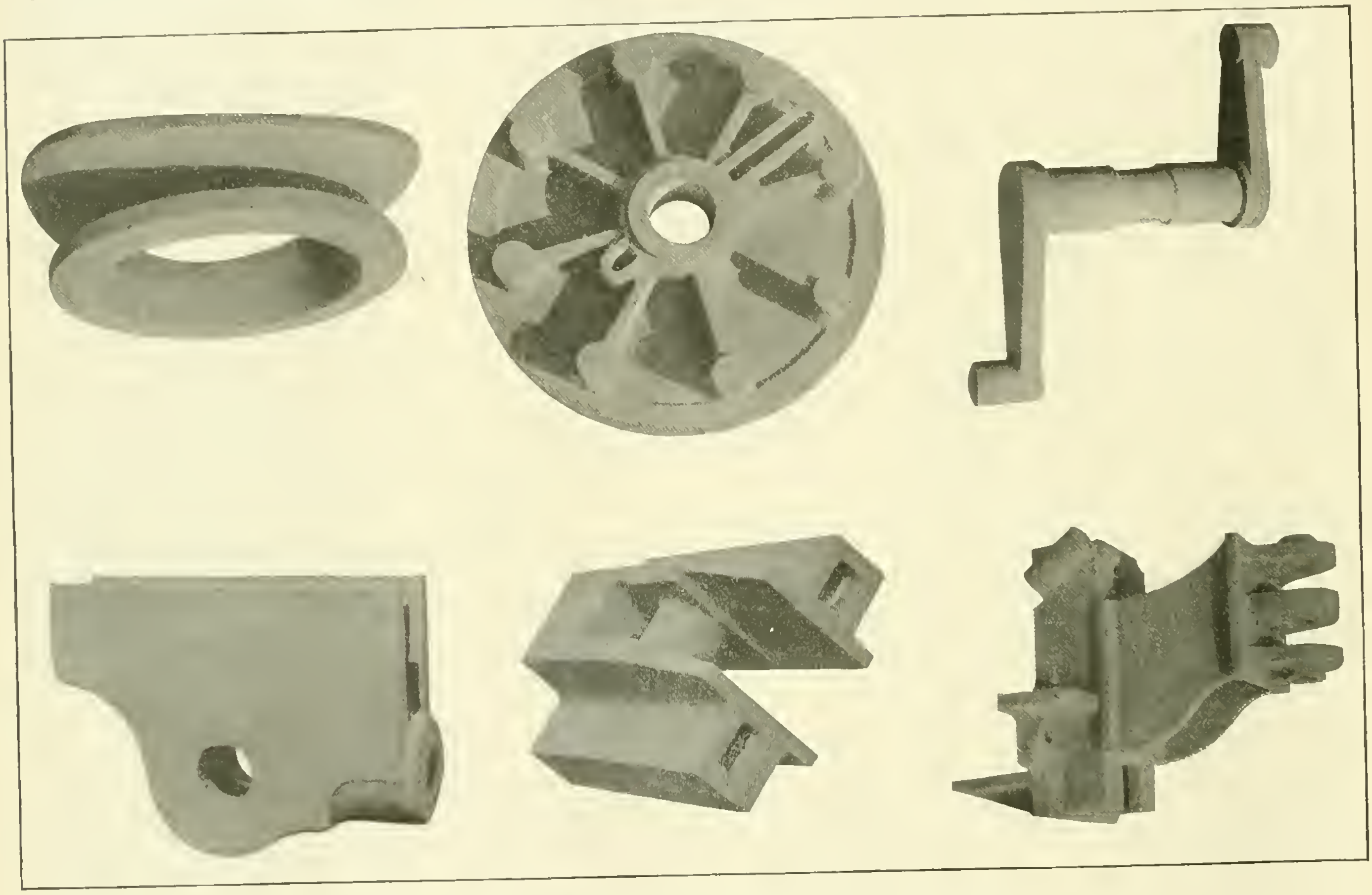
Piece Work and Premium Plan.

BY R. T. SHEA.

The subject of piece work seems to be foremost in the minds of many of our mechanical men at present, and many are also considering what is known as the premium plan, as explained in LOCOMOTIVE ENGINEERING of November, 1899, and many are wondering if either will pay to introduce, and the men who are not familiar with piece-pay system, either direct or in a modified form, are very much opposed to any change, "the mental habit which makes anything that has long existed seem material and necessary" being the main reason with them; but experience has proven that the same men, who were opposed in the start to piece work, in a shop where it is properly handled, are now just as much opposed to day work, and would not change back. I have in mind a shop where all work is d ne on piece-work plan, where day rates for mechanics are about $2.50 per day, but as there is very little day work done, their earnings are much greater. A shop in a nearby town wanted men, and sent word to those piece workers that four of their number could have day-work jobs at $2.90 per day, and yet not a man would give up his piece-work job to accept the offer. I also know of many cases where men whom I class as artists in their business gave up day work in some of our best railroad shops to accept piece-work jobs, and I know a large number of mechanics whose ability and skill are unquestioned and who would be glad of a chance to change from day work to piece work. In view of these facts, I am free to confess that I can't see why the direct piece-work system should meet with so much opposition, or why it should be necessary to invent modified forms, wherein I claim the workman gets the worst of the bargain.

Taking the men's view of the case, I can see why they who are not familiar with piece work or who are working it where it is not properly handled, are so much opposed to it. I will cite a few cases that came under my observation. A workman in a wood-working department, whose day rate was $2.50, was given a piece-work job, and by hard work and devising a new method of performing this work, made $3.80 per day. When he was through, his foreman very promptly told him that he was unreasonable, and made too much money, and he would only be allowed his day rate; but as he had the right to appeal, and did so, he received the $3.80, and is still receiving it, and will continue to get it until he has been amply rewarded for his inventive genius. Another case was that of a man running a drill press. His earnings increased about 50 per cent. over his day rate, and his foreman handled him in the same way. The foreman's defense, when questioned as to why it was, explained that when the man worked day work he used the feed, when on piece work he used special drills, and fed them by hand all they would stand. This man is now getting the original price, and will continue to get it, and will make this increased pay as long as he puts forth this effort. I could cite instances of this kind in different shops on several railroads, and where this practice is allowed is it any wonder that the men are dissatisfied? The trouble seems to be that in many cases the management forget that the men have rights as well as the company. Another thing they seem sometimes to loose track of is, that the masses of shopmen to-day are far above the average in intelligence and education, and can and do use their brains to good advantage when they take contracts, and by so doing largely increase their earnings, and the companies can well afford to let them. If you agree to pay $100 to a carpenter for building a house, you pay it without question, regardless of whether he makes $2 or $10 per day. This principle should apply with your men. If prices are unfair to either the men or the company, there is an equitable way of adjusting them that is fair to both, varying according to conditions, and where men are treated fair there is never any friction on this score.

In regard to the premium plan, my main objection to it is that it is so one-sided—all for the company, nothing for the man.



SOME STEEL CASTINGS MADE BY SHICKLE, HARRISON & HOWARD.

Take the turning of tires for an illustration—price for this job is $3; time limit on premium plan is ten hours. If workman turns tires in eight hours, you cut him 60 cents, paying $2.40 instead of $3. If he turns them in five hours, as he will sometimes do, then you cut him $1, paying $2 for the operation. At the same time, admitting that the company is willing to pay $3, most men would expect the $3 for the turning of the tires, regardless of the time, and would seriously object to being cut $1. If they gained on this tire job five hours time, the company has made more than the men by doubling the output of the machine, and should be willing to pay the price agreed on. Loss to man in this case is $1; gain to company, 5 hours time of machine, at $1 per hour, $5, figuring that this machine is worth $1 per hour. I fail to see where the justice comes in to the man.

After a fair test, if it is considered worth $3 for a given operation, pay it, I should say; and if a man can save two or five hours time, the company has increased the output at a decreased cost per piece, and the man his earnings; and this is the result sought, and is fair to both. The advocates of the premium plan say, great care must be used in setting the time limit, never getting it too high. Suppose you get it too low, then what? Now in regard to getting the rate too high or just right, if there is a man in the country who is infallible or can get these rates just right, I imagine any system of railroad would pay him a princely salary. Up to this time that man has not been found. Years of practical experience at rate-setting have convinced me that you can measure the capacity of any machine, but you cannot calculate the capacity of the up-to-date shop man's brain when he knows that the rate being fixed there is no limit to the earnings. When you think you know just what can be done in a given time, he will probably convince you that you are the most fooled man around the plant. Now suppose a man don't turn these tires in ten hours, the time limit, then what? You say a good workman will never exceed the time limit. We know from experience that the best of men will exceed the time limits when everything seems all right, and do so honestly, and that the worry and strain of the foreman, finding fault because they have done so, is harder on the average man than doing the work, and he will feel that his job is hanging by a thread and become very much dissatisfied if many cases of this kind occur. If he receives $3 for the operation, time cuts no figure, and if for some reason he don't do it in a given time, he feels that it is a matter of more importance to him than anyone else, and don't worry over it.

It is claimed that piece work is a hard system to introduce, and it is only successful where unusual tact is used. Our views and experience are just the opposite to this, and it is a success beyond question if properly organized, better for the men and also for the company, and the only tact required is ordinary business judgment and plain, fair business methods that can't be questioned. Like a solid savings bank, always have your books and methods open for inspection of those interested, nothing to conceal or be afraid to explain, and always ready to listen to the men's side of the case when there is anything to discuss, or always ready to have the auditor check the company's side.

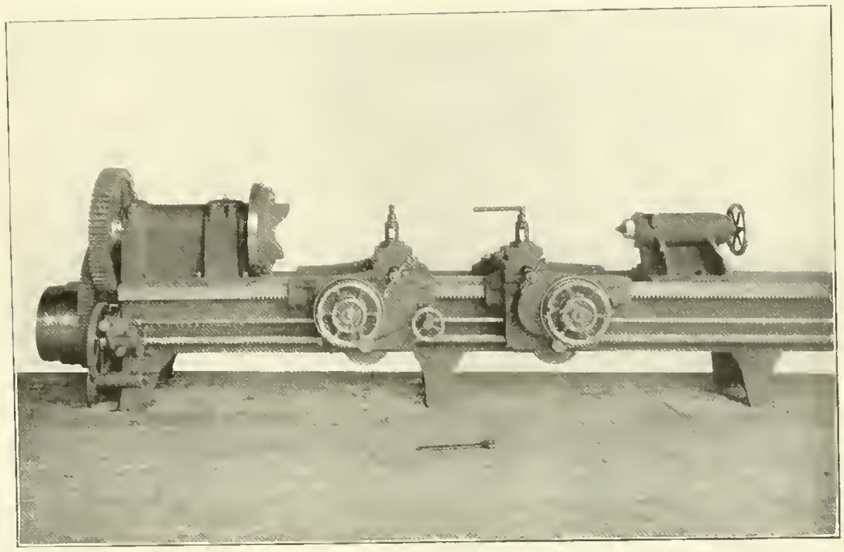
[We have made some comments on this letter in our editorial department.—Ed.]

A. O. Norton, Boston, Mass., manufacturer of ball-bearing lifting jacks, has added additional machinery to his already well equipped plant, to keep up with the increasing demand for his product. He reports several large export orders received this month.

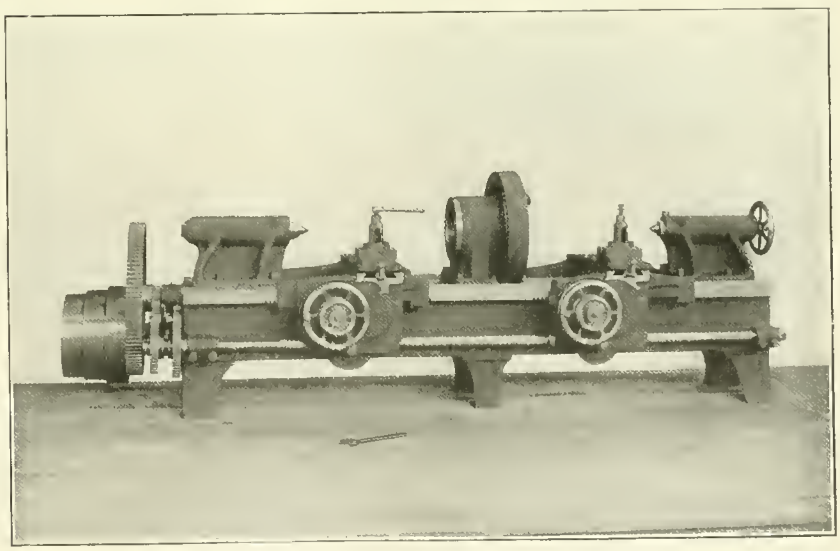
Heavy Locomotive and Car Axle Lathes.

These lathes have recently been designed by Bement, Miles & Co., of Philadelphia, and are good examples of modern machine tools. They take in axles 8 feet long, the bed being 13 feet 3 inches in length, but this can of course be increased if desired. It is driven by a 5-inch belt with three changes of speed, and has cut gearing with a ratio of 30 to 1.

The carriages are made right and left handed, so as to bring cutting tools nearer together, and can be provided with a forming attachment if desired. Feeds vary in any way desired, from 1-18 to ½ inch per revolution, and are easily operated by friction disks.



BEMENT, MILES & CO. AXLE LATHE, END DRIVEN.



BEMENT, MILES & CO. AXLE LATHE, CENTER DRIVEN.

This machine is also made with a center driving arrangement, so that both ends can be turned at the same time. This is shown in one of the accompanying illustrations. These machines are also arranged to be driven by independent electric motors when desired.

South African Railways.

The present conflict in Africa makes the following—from *Transport*—doubly interesting:

One of the features of the South Africa of to-day is the glaring contrast between the present and the quite recent past, due to the development of the country; and nowhere, perhaps, is this characteristic more strikingly shown than in the modes of traveling. In England the transition from the stage-coach to the express dining and sleeping train has been a comparatively slow process, but in South Africa we find the two in employment almost side by side. South Africa has known no slow transition in traveling facilities. The problem of communication has been worked out and solved for her by the mother country, and she has leaped, as it were, at one bound from the oxen-drawn wagon to the locomotive. The journey from Southampton to Bulawayo, the present terminus of the great Trans-African Railway, via Cape Town, can now be done in an average of 22½ days. The distance is 7,338 miles, and may be covered by means of the Castle and Union Steamship Company's magnificent steamers and the great trunk railway of South Africa, for eighteen guineas, third-class. A few years ago the journey would have taken months, and have cost double, if not treble, the money. The distance from Cape Town to Bulawayo by rail is 1,360 miles, and the fares are: First-class, £18 8s.; second-class, £12 5s.; third-class, £5 13s. The construction of the railway so far as Bulawayo was a "record" performance, for during the twelve months ended October 19, 1897—when the rails reached Bulawayo—no less than 335 miles were constructed.

Leaving Cape Town by the Northern Express, the passenger *en route* for Bulawayo passes through the lovely scenery of the Hex River Mountains and over the Karoo to Kimberley, the seat of the diamond industry, which is reached in 31 hours. From Kimberley to Mafeking occupies another day. Vryburg, the starting point of the Rhodesian Railways, is passed half way. Mafeking is a busy little town, and an important receiving and forwarding center, situated in the heart of a dense native population, with whom a considerable trade is carried on. The railway company has erected large engine sheds and workshops here. After passing Mafeking the journey is full of interest to newcomers. The line passes by numerous native villages, whose scantily-clothed inhabitants throng round the train at each stopping place begging for food, tobacco and coppers. The only other town of importance before Bulawayo is reached is Francistown, the business center of the Tati Concessions Company. Bulawayo is reached 3½ days after leaving Cape Town. As far as Mafeking no difficulty is experienced in obtaining meals at regular intervals, but from Mafeking it is advisable to carry a basket of provisions in case of emergencies.

It is a little unfortunate that the trains reach Bulawayo after nightfall, as first impressions under such circumstances are never of the most favorable, but the traveler nowadays can be congratulated upon making the journey by train instead of having to undergo the wearisome monotony of a coach or wagon journey. The accommodation afforded to passengers on the Rhodesia Railways is everything that can be desired, and the saloons that leave Cape Town daily run right through to Bulawayo. Some of them, it may be added, are fitted with the electric light by Stone's system of axle-lighting.

For anyone visiting Bulawayo for the first time, it is hard to realize that a town of such size, with massive stone and brick buildings in every street, churches, hospitals, stock exchange, Government offices, banks, clubs and hotels equal to any in South Africa—the whole town brilliantly illuminated by the electric light—has sprung into being within the last five years. The town is the center of several important mining districts. That known as the Gwanda, eighty miles south, is reached by coach. Gwelo is a rising town twenty-four hours' journey by coach from Bulawayo.

The extension of the railway to the town has already been commenced. From Gwelo to Salisbury there is an excellent coach service, the journey occupying some forty-eight hours, including a liberal allowance for sleep each night at wayside hotels. These wayside hotels, which are situated at short intervals along all the main roads, afford excellent accommodation for travelers, and where coach passengers had formerly to carry and cook their own food, good meals are now always obtainable.

The town of Victoria is situated midway between Salisbury and Tuli, the latter being the first fort established by the pioneers in 1890. The Victoria district is termed the Garden of Rhodesia, and enormous quantities of grain are raised there. It is also one of the first districts in which gold was discovered, and it is again attracting the attention of the mining community. It is expected that the terminus of the Gwanda Railway will be in the neighborhood of Tuli, and large deposits of coal are now being developed in the district.

Salisbury—the heart of the mining districts—the capital of Rhodesia and the seat of Government, is a large town, occupying an eminently healthy site amid picturesque surroundings. The suburbs of Salisbury are charming and the gardens most beautiful. All the English flowers and many of the fruits thrive, roses doing exceptionally well. Being at an elevation of nearly 5,000 feet, the climate of Salisbury is unequalled, for while the heat is never excessive, the nights are always cool. The race-course is one of the finest in South Africa, and cricket and football and every form of sport are keenly supported. The railway is now open to Salisbury from the east coast port of Beira, and with the facilities thus afforded for the transport of machinery, development work will be rapidly pushed forward.

Does the Brick Arch Cause Leaky Flues?

Will you kindly give us, through your valuable paper, the reasons why a brick arch will cause flues to leak in the firebox? We are taught that the brick arch not only helps to save fuel, but also protects and lengthens the life of flues. Practice has demonstrated positively in some of our locomotives here on the Chicago & West Michigan, that a brick arch in the box causes the flues to leak, beginning directly after the arch is put in and the engine does hard labor.

Our brick arches are in three pieces, placed lengthways in the firebox and resting on four plugs screwed into the side sheets. The brick is cut away next the flue sheet and side sheets to allow cinders and fine coal to drop down to the grates, and next the flue sheet only about 6 inches of each corner of the arch rests against flue sheet from 6 to 10 inches below the flues.

I have talked with several of the old runners here on the Chicago & West Michigan, who positively assert that the presence of an arch insures leaking flues, but have not found a satisfactory reason, and would very much like to hear your views of the matter. M. D. Corbus.

Muskegon, Mich.

[As we have generally heard it asserted that the brick arch helps to prevent flues from leaking, we should like to know of any other evidence in support of the views held by our correspondent. The subject is quite important, and on that account we should like to obtain the views of our readers who have had experience with the brick arch.—Ed.]

Thinks He is Well Known.

We seldom touch on the subject of advertising in these columns, but a recent experience is too good to keep. One of our representatives, after considerable difficulty, found the little shop of a manufacturer, only to be told that he was so well known that he didn't need to advertise.

The funny part is that street car conductors on the line within a block of his door never heard of him, and wouldn't believe there was a man of that kind in the neighborhood. Yet he fondly imagines that his name is on the tongue of every railroad shop man because he has been in business several years and once or twice used a 1-inch advertisement.

The Southern Pacific management have issued notice to connecting lines that they will not accept freight cars that are longer than 41 feet.

Schenectady Ten-Wheeler for Florence & Cripple Creek Railroad.

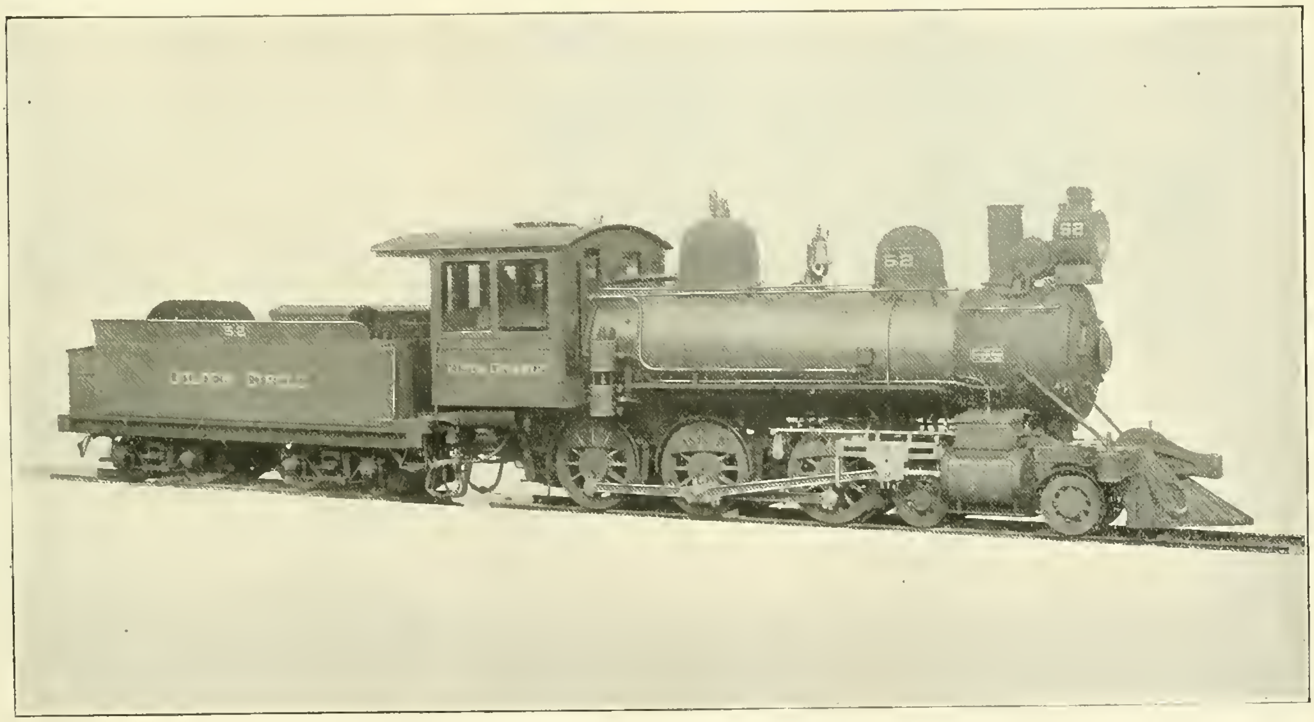
The handsome ten-wheel engine here shown has some notable features, being built for a railroad of 3-foot gage, and possessing power equal to what standard gage ten-wheelers were a very few years ago. The engine weighs 82,200 pounds in working order, of which 66,500 pounds are on the drivers. The rigid wheel-base is 9 feet 9 inches, the total being 18 feet 2 inches. The engine has tractive power of about 21,000 pounds.

The cylinders are 16 x 20 inches; horizontal thickness of piston, 4⅞ inches; diameter of piston rod, 2¾ inches. Cast-iron packing is used. The ports are 14 inches long, steam port being 1¼ inches wide, inside port 2½ inches wide. The valves are Richardson balanced, with 5 inches travel, ¾ inch outside lap and set with 1-16 inch lead in full gear.

The driving wheels have cast-iron centers, and are 42 inches diameter outside of tires. The driving boxes are made of steel cast iron. The main driving axle journals are 7 x 8 inches; main crank-pin journals, 5 x 5 inches; side-rod crank-pin, 3½ x 3¼ inches.

The boiler, as will be noticed, is of the extended wagon-top type, 52 inches diameter and carrying 180 pounds of steam. The firebox is 84 3-16 inches long, 24⅛ inches wide, 47 inches deep in front and 45 inches at the back. The crown is supported by radial staybolts, 1 inch diameter, made of special iron. There are 171 2-inch tubes, 11 feet 8 inches long. The total heating surface is 1,130.06 square feet, of which 92.97 square feet are in the firebox. The grate has 14.1 square feet of area.

Among the equipment specified are: United States metallic packing for the glands, basic steel for the boiler, Westinghouse-American combined brakes on drivers and tenders, 9½-inch air pump, two Coales safety valves, Pyle National electric headlight, Safety Car Heating & Lighting Company's steam-heat equipment, including Mason reducing valve.



SCHENECTADY TEN-WHEELER FOR FLORENCE & CRIPPLE CREEK RAILROAD.

The Whistle Nuisance in England.

Americans who have heard the whistles on British locomotives are generally struck with the feeble sound emitted, and railroad men marvel that the whistle produces a signal loud enough to be heard at the back end of the train; yet that feeble whistle seems to be an irritating nuisance to some people. We have recently read some correspondence in which very strong expressions were used about the noise of locomotive whistles. One writer says:

"Need a whistle be so loud, so discordant and so long, and need it be so often repeated? Could not a bell, a horn, or some electric contrivance be substituted for a sudden scream which can be heard at a distance far beyond what is necessary? Will not someone take out a patent for an effective mode of signalling which will dispense with the loud, ear-torturing, intolerable shrieks of the railway whistle?"

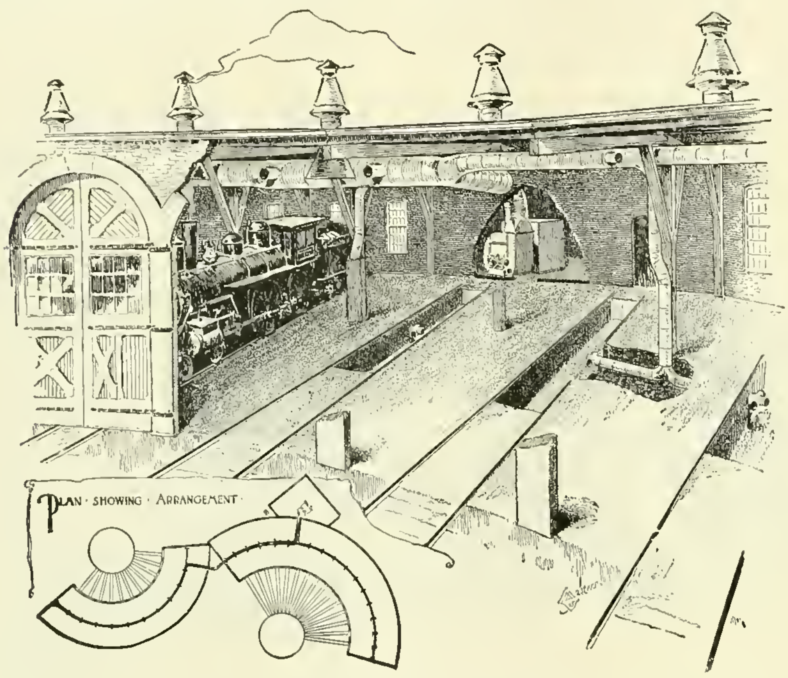
Misery in regard to these matters is very often a matter of degree. An American whistle could be depended on to be heard ten times as far as an English whistle and to be about one thousand times more ear-torturing. We think if the people who complain about the English whistle only went through the agony of hearing the whistle of an American locomotive screaming through the country in the middle of the night, they would be thankful that the English whistle was no worse than it is.

In our description of the Lehigh Valley shops at Sayre, Pa., we omitted to mention that the Buffalo Forge Company supplied the forge shop equipment, the down-draft forges being used. The Buffalo Forge Company control the patents for this sort of forge, and find that it is becoming highly popular in blacksmith shops.

The Consolidated Car Heating Company some time ago instituted a suit against the Palmer-Monson Street Railway Company for using the Gold system of car heating, which they allege was an infringement on one of the patents controlled by the company. The Gold Car Heating Company voluntarily defended the suit, and the suit has been dismissed on the ground that there was no infringement. Two interference suits in the United States Patent Office relating to valuable improvements in electric heating, prosecuted by the Consolidated Car Heating Company in support of the application of James F. McElroy and by the Gold Car Heating Company in support of the application of Edward D. Gold, have both been decided in favor of the Gold Car Heating Company, not only in ordinary hearing, but also in appeal.

Heating a Locomotive Roundhouse.

An excellent example of a modern installation of the blower system for heating a roundhouse is presented in the accompanying illustration. Only a portion of one roundhouse is shown in the view, although, as indicated in the plan, there are two independent houses both supplied by the same system of piping. In the interior view is shown the heating apparatus, consisting of a fan with attached engine and a steam heater, across the pipes of which the air is drawn, and thence forced to the overhead system of galvanized iron piping, which conforms in direction to the center line of each of the roundhouses,



HEATING "OMAHA" SHOPS AT EAST ST. PAUL.

and is provided with outlet openings for the discharge of air toward the exterior walls.

The result of this arrangement is that large volumes of warm air are supplied, that the distribution of air is complete, and the tendency to leakage is outward, thereby preventing inward drafts.

All of the heating surface is concentrated in connection with the fan. The high velocity of the air passing across the pipes of the heater renders them nearly five times as efficient as would be the same amount of surface exposed as direct radiation within the building. In other words, about one-fifth of the heating surface is required to secure the same results.

The most interesting feature of this installation, however, consists in the means employed for warming the pits and rapidly melting the snow and ice from the running gear of the locomotives during the winter season. At intervals are introduced downward connecting pipes with extensions to the various pits. As a rule, the requirement for air discharge to the pits is only temporary, so the pipes are made large in order that the supply may be ample.

A three-fold outlet serves to effectually distribute the air within the pits, whence it rises in even volume across the parts of the locomotive above, and because of its high temperature, greedily absorbs all moisture which may be present. By this means the time required for again putting the locomotive in service is very much reduced.

This plant was designed and installed by the B. F. Sturtevant Company, of Boston, Mass., for the Chicago, St. Paul, Minneapolis & Omaha Railway at East St. Paul, Minn.

A Sand Lifter Wanted.

If some bright genius will invent, test and perfect a device like an ejector which will lift all the sand out of a locomotive sandbox and pass it down through a pipe to a receptacle on the floor without scattering any sand on the engine, the roundhouse force will rise up and call him blessed.

The old way of baling it out into a pail is too slow, and it is worse yet to wait for it to run out through the sand pipes to the rail. Stoppage of these pipes is the usual cause for emptying the box.

The device should be portable, so it can be put in at the top opening and fit any depth of box. The supply of air to operate it can be taken through a hose from the shop pipe or from the train pipe of a locomotive.

This looks like an easy matter to arrange for. Those who have tried it say that it is difficult, that the sand chokes up the pipe.

Try for a new plan, boys, and let us know how it is done when you are successful.

Old-Time Sleeper Condemned.

The first sleeping car, the "Pioneer," built by the late George M. Pullman, which in a very large measure laid the foundation of his fortune and several others, has just been pulled into the "bone-yard" in Pullman, Ill. It has been condemned. It will soon be kindling wood, scrap iron and a memory merely. Its last use was to help carry the Forty-third infantry across the continent on the way to the Philippines. During the war with Spain it was a tourist sleeper, and as such many a regular and volunteer soldier made its acquaintance.

In 1865—the most magnificent of its kind—it was sent East and returned the bearer of the body of Abraham Lincoln. And in the three decades of its life it has carried at least ten Governors of Illinois, besides at one time or another almost every Northern man prominent either in politics or trade.

During the World's Fair the "Pioneer" and an example of the latest output of the Pullman works were exhibited side by side. It was allowed to rest after this exhibition until the war with Spain taxed the country's transportation facilities to the limit. Then it went to work again. Now the "Pioneer" is an officially condemned cast-off.

The "Pioneer" has a travel record equal to a trip forty times around the world. It averaged 50,000 miles yearly in its runs between Chicago and St. Louis. Its every other day trip was 283 miles. It has spent at least twenty-five years in actual traveling.

The car is a historical relic and ought not to be broken up. As years go by, the car will become more and more interesting. If the Pullman Company cannot find a place to preserve it in, the car ought to be sent to the Columbian Exhibition.

The Sargent Company, of Chicago, have issued an index to the M. C. B. book of rules, and also a knuckle chart, which contains illustrations of all the M. C. B. coupler knuckles in use. This index will be found exceedingly convenient by car inspectors, car repairers and others, as they can find out any item of information immediately by inspecting the index. A prominent superintendent of motive power writing about the index says: "I have your circular regarding supply of index to M. C. B. code of rules, and beg to acknowledge receipt of the form, which is certainly a big improvement on the rules. They will serve as a guide and ready reference which will be much appreciated. I have placed it in the hands of our employés entitled to the M. C. B. rules."

The famous engineer Tredgold said that "Engineering is the art of directing the great sources of power in nature." It is a good definition and can scarcely be improved upon.

Personal Department.

Mr. W. H. Gridley has been appointed assistant to the general superintendent of the Chicago & Alton at Bloomington, Ill.

Mr. W. H. Holland has been appointed general foreman of the Lake Shore & Michigan Southern shops at Norwalk, O.

Mr. S. B. Mason has been appointed assistant to the mechanical superintendent of the Baltimore & Ohio at Mt. Clare, Md.

Mr. G. F. Roberts has been appointed assistant superintendent of the Hoosac Tunnel & Wilmington at Holyoke, Mass.

Mr. F. B. Hubbard has been appointed trainmaster of the Portland division of the Maine Central, vice Mr. S. C. Manley, resigned.

Mr. Clarence Price has been appointed purchasing agent of the Chicago & Alton at Chicago, Ill., succeeding Mr. A. V. Hartwell, resigned.

Mr. S. L. Yendes has been appointed master mechanic of the Milwaukee, Benton Harbor & Columbus at Benton Harbor, Mich., vice Mr. F. J. Pease.

Mr. W. J. Wilcox, division master mechanic on the Santa Fe route at Winslow, Ariz., has been transferred to Los Angeles, Cal., as division foreman.

Mr. Richard Doyle, trainmaster of the Cleveland, Cincinnati, Chicago & St. Louis at Mattoon, Ill., has resigned to accept a similar position on the Wabash.

Mr. Winfield S. Haines has been appointed division master mechanic of the Baltimore & Ohio at Newark, Ohio, vice Mr. W. H. Harrison, Jr., resigned.

Mr. B. W. Fenton has been appointed general superintendent of the Findlay, Fort Wayne & Western at Findlay, Ohio, succeeding Mr. Charles Hine, resigned.

Mr. S. Sanborn, general superintendent of the Chicago & Northwestern, has been promoted to the position of assistant general manager, with office at Chicago, Ill.

Mr. F. R. Rockwell, recently appointed trainmaster of the Florence & Cripple Creek, has been advanced to the position of superintendent; office at Florence, Colo.

Mr. C. E. Fuller, late superintendent of motive power of the Central Vermont, has been appointed master mechanic of the Erie; headquarters at Susquehanna, Pa.

Mr. F. S. Forest, assistant superintendent of the Spokane Falls & Northern, has been promoted to the position of superintendent; headquarters at Spokane, Wash.

Mr. F. H. Clark, chief draftsman of the mechanical department of the Chicago, Burlington & Quincy, has been appointed mechanical engineer, with office at Aurora, Ill.

Mr. D. J. Redding, foreman of locomotive and car repairs of the Pittsburgh & Lake Erie, has been promoted to the position of master mechanic at McKees Rocks, Pa.

Mr. H. U. Mudge, general superintendent of the Atchison, Topeka & Santa Fe, has been selected to succeed Mr. J. J. Frey as general manager, with office at Topeka, Kan.

Mr. W. D. Scott has been appointed superintendent of the Cascade division of the Great Northern, with office at Everett, Wash., vice Mr. Fred G. Williams, transferred.

Mr. H. G. Farrar, chief train dispatcher at Birmingham of the Southern, has been made trainmaster, with office at Birmingham, Ala., vice Mr. C. S. Hayden, promoted.

Mr. G. W. Gould has been appointed roundhouse foreman at Shoreham, Minn., of the Minneapolis, St. Paul & Sault Ste. Marie, vice Mr. S. N. Woodruff, promoted.

Mr. S. N. Woodruff has been appointed district master mechanic of the Minneapolis, St. Paul & Sault Ste. Marie at Gladstone, Mich., vice Mr. W. S. Haines, resigned.

Mr. M. F. White has been appointed assistant superintendent of the Western Iowa division of the Chicago & Northwestern at Boone, Ia., succeeding Mr. W. O. Litten.

Mr. W. L. Gilmore, master mechanic of the Lake Shore & Michigan Southern at Elkhart, Ind., has resigned. Mr. Gilmore has filled his present position for the past sixteen years.

Mr. C. L. Ewing, superintendent of the Anniston division of the Southern, has been transferred to the Knoxville division at Knoxville, Tenn., succeeding Mr. F. K. Huger, resigned.

Mr. M. W. Maguire has been appointed superintendent of the Chattanooga division of the Cincinnati, New Orleans & Texas Pacific at Somerset, Ky., succeeding Mr. A Griggs, resigned.

J. Charles Cox died at Pittsburgh, Pa., last month. He was an old railroad man, having been for years on the Pittsburgh & Connelsville, and had a very wide railroad acquaintance.

Mr. G. F. Huggans has been appointed superintendent of the Atlanta & West Point and Western of Alabama, with office at Montgomery, Ala., succeeding Mr. P. T. Downs, resigned.

Mr. George H. Horton has had his territory as traveling engineer on the Minneapolis, St. Paul & Sault Ste. Marie extended to all divisions of that road; headquarters at Gladstone, Mich.

Mr. William A. Gardner, assistant general superintendent of the Chicago & Northwestern, has been appointed general manager, vice John M. Whitman, promoted; office at Chicago, Ill.

Mr. John Player, superintendent of machinery of the Atchison, Topeka & Santa Fe at Topeka, Kan., has had his jurisdiction extended over the Santa Fe, Southern California and S. F. & S. V.

Mr. R. H. Ashton, superintendent of the Iowa division of the Chicago & Northwestern, has been promoted to the position of general superintendent at Chicago, in place of Mr. S. Sanborn, promoted.

Mr. M. H. Milli, chief clerk to the general superintendent of the Fort Worth & Denver City, has been appointed assistant superintendent, vice Mr. C. M. Hunt, resigned; office at Fort Worth, Texas.

Mr. C. S. Hayden, trainmaster of the Southern at Birmingham, Ala., has been promoted to the position of superintendent of the Anniston division at Selma, Ala., in place of Mr. C. L. Ewing, transferred.

Mr. A. Griggs, superintendent of the Cincinnati, New Orleans & Texas Pacific at Somerset, Ky., has resigned to become superintendent of the Eastern division of the Chicago & Alton at Bloomington, Ill.

Mr. A. C. Ridgway, general superintendent of the Florence & Cripple Creek, has resigned to become general manager of the Colorado Springs & Cripple Creek district, with office at Colorado Springs, Colo.

It is reported that Mr. C. Shields, assistant general superintendent of the Great Northern at Spokane, Wash., has resigned to accept the position of general manager of the Virginia & Southwestern at Bristol, Tenn.

Mr. J. W. Logsdon, superintendent of the Cumberland Valley division of the Louisville & Nashville at Middlesboro, Ky., has been transferred to the Louisville division at Louisville, Ky., vice Mr. B. M. Stark.

Mr. W. H. Baldwin, Jr., president of the Long Island Railroad, read a paper on "Railroad Relief and Beneficiary Associations" before the American Economic Association in Cornell University on December 28.

Mr. James M. Thomson. Jr., roundhouse foreman of the Norfolk & Western at East Radford, Va., has been promoted to general foreman of the shops at Portsmouth, Ohio, in place of Mr. J. Cullinan, resigned.

Mr. J. B. Tennant, general foreman of the Illinois Central at Memphis, Tenn., has been appointed master mechanic of the New Orleans & Northwestern at Vidalia, La., in place of Mr. J. H. McGill, resigned.

Mr. Avery Turner, assistant superintendent of the Atchison, Topeka & Santa Fe, has been promoted to the position of superintendent of the Chicago division at Chicago, Ill., succeeding Mr. W. C. Nixon, promoted.

Mr. C. F. Resseguie, general superintendent of the Gulf, Colorado & Santa Fe, has resigned to accept a similar position on the Atchison, Topeka & Santa Fe, succeeding Mr. H. W. Mudge; office at Topeka, Kan.

Mr. W. E. Knox, superintendent of the Alabama Mineral division of the Louisville & Nashville, has been appointed superintendent of the Cumberland Valley division at Middlesboro, Ky., vice Mr. J. W. Logsdon.

Mr. Fred G. Williamson, assistant superintendent of the Cascade division of the Great Northern, has been transferred to the Dakota division, with office at Laramie, N. Dak., succeeding Mr. R. C. Morgan, resigned.

Mr. C. E. Soule, assistant superintendent of the Central Vermont at New London, Conn., has been promoted to the position of superintendent, with office at St. Albans, Vt., succeeding Mr. F. W. Baldwin, resigned.

Mr. P. T. Downs, superintendent of the Atlanta & West Point and Western of Alabama, has resigned to accept the position of assistant general superintendent of the Great Northern, with headquarters at Spokane, Wash.

Mr. W. D. Robb, division master mechanic of the Grand Trunk at Toronto, Ont., has been appointed superintendent of motive power of the Central Vermont at St. Albans, Vt., succeeding Mr. C. E. Fuller, resigned.

Mr. C. E. Houghton, traveling engineer of the Toledo division of the Lake Shore & Michigan Southern, has been appointed foreman of engine houses at Toledo and Air Line Junction in place of J. H. Calkins, transferred.

Mr. R. H. Soule, who has been connected with the Baldwin Locomotive Works for the last few years, has resigned the position of Western representative and expects to return to railroad work in the near future.

Mr. J. H. Calkins, engine house foreman for the Lake Shore & Michigan Southern at Air Line Junction and Toledo, Ohio, has been appointed engine dispatcher at Elkhart, Ind., in place of W. O. Thompson, resigned.

Mr. C. E. Slayton, division master mechanic of the Chicago Great Western at Dubuque, Iowa, has resigned to become master mechanic of the Virginia & Southwestern at Bristol, Tenn., succeeding Mr. T. R. Shanks, resigned.

Mr. James Buchanan, division superintendent of motive power of the New York Central & Hudson River at West Albany, N. Y., has resigned to accept the position of master mechanic of the Delaware & Hudson at Green Island, N. Y.

Mr. W. C. Nixon, superintendent of the Chicago division of the Atchison, Topeka & Santa Fe, has been appointed general superintendent of the Gulf, Colorado & Santa Fe at Galveston, Texas. He succeeds Mr. C. F. Resseguie, promoted.

Mr. David Brown, master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa., has resigned. Mr. Brown had been a long time with the Delaware, Lackawanna & Western, and was noted as a particularly efficient shop manager.

Mr. S. P. Bush, superintendent of motive power on the Southwest system of the Pennsylvania, has resigned to accept the position of superintendent of motive power of the Chicago, Milwaukee & St. Paul at Milwaukee, Wis., vice Mr. J. N. Barr, resigned.

Mr. G. M. Tower, formerly general foreman with the Fitchburg Railroad, has taken a position with the Delaware & Hudson. He is open for engagement with any railroad to advance modern methods in shop work and to introduce labor saving devices.

Mr. Edward Elden, master mechanic of the Lake Shore & Michigan Southern at Buffalo, N. Y., has resigned, and the office of division master mechanic at that point has been abolished and the Buffalo division has been placed under the supervision of Mr. A. A. Bradeen, master mechanic at Cleveland, Ohio.

Mr. Frank S. De Ronde, who has been well known as the general sales agent of the Standard Paint Company for the past thirteen years, has established the Frank S. De Ronde Company, at 54 John street, New York. They succeed to the business of the National Supply Company and will handle railway supplies, making a specialty of Lythite—the standard cold-water paint—roofing material and preservative paints.

At a recent meeting of the Westinghouse Air-Brake Company, Mr. H. H. Westinghouse was elected vice-president and Mr. E. M. Herr general manager. Mr. J. F. Miller was elected assistant secretary. We have a feeling that Mr. Westinghouse allowed higher honors to be extended to him in order that a good turn could be given to Mr. Herr, who deserves all the good things that can be sent in his direction.

Business is so active with the Bullock Electric Manufacturing Company that they have been compelled to extend their main building 200 feet. This makes the principal machine shop 500 feet long by 101 feet wide.

Dr. Edward H. Williams.

As we go to press, an announcement has reached us of the death, from heart trouble, of Dr. Edward H. Williams, one of the partners of Burnham, Williams & Co., of the Baldwin Locomotive Works, which happened at Santa Barbara, Cal., where Dr. Williams has spent the greater part of the time for several years past. Dr. Williams was seventy-five years old at the time of his death. He was born at Woodstock, Vt., and graduated as M. D. in the Vermont Medical College. He did not like the practice of medicine, and soon gave it up to enter into railroad work. He joined an engineers corps and had some experience in railroad location, and then he became a railroad superintendent. He filled several railroad positions, constantly advancing, until he became general superintendent of the Pennsylvania Railroad. While holding that position he made a thorough reorganization of the operative officials, and the methods which he introduced formed the foundation of the excellent system of organization under which the Pennsylvania Railroad is managed today. He left on the Pennsylvania Railroad a wonderful list of proteges whom he had drawn into the service, among them Mr. F. L. Sheppard, now general superintendent at Jersey City.

In 1870 Dr. Williams became a member of the Baldwin Locomotive Works firm, and inspired into the concern a great deal of vitality, which helped in a great measure to bring about the splendid prosperity which the works have enjoyed for many years. Dr. Williams went earnestly and systematically to the extending of the business of the firm in foreign countries, and for years he kept traveling in all countries that had railroads. In this work of selling Baldwin locomotives abroad he was eminently successful.

Ten years ago the writer crossed the Atlantic on the same steamer with Dr. Williams. Mr. A. J. Pitkin, of the Schenectady Locomotive Works, was with us, and it was a never-to-be-forgotten voyage. The doctor had a magnificent fund of anecdotes and stories, and the time passed like the reading of a fairy tale. In his death we lament the loss of a personal friend, and Locomotive Engineering has lost an admirer who was always ready to speak in its praise to the many railroad men he met at home and abroad.

The Terminal Railroad Association of St. Louis have just finished an addition to their shop, of brick and iron, 88 x 100 feet, containing three pits for erecting and repairing engines, with considerable new machinery. The roundhouse is also being rebuilt, new pits of concrete going in. There is room for ten engines. The new brick store-room and oil-house is about finished. There are forty-five engines in service under the charge of Mr. H. M. Smith, master mechanic; two new ones having been added this past year.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(1) F. G. W., Albuquerque, N. M., asks:

Has there ever been a conference of general managers and locomotive engineers in which there was an agreement to allow locomotive engineers to wear eyeglasses while on duty? A.—We do not believe that any such conference was ever held.

(2) R. H., Bucyrus, Ohio, writes:

A dispute has arisen at this place regarding the speed of trains. Some of the people insist that no train has ever been run a distance of 60 miles in as many minutes, and they refer to you for a decision. A.—Thousands of trains with well authenticated records have been run 100 miles in 100 minutes.

(3) C. H. R., Lincoln, Neb., writes:

Why are the boiler checks in locomotive boilers put on a line with the crown sheet, and will the injector work successfully with the water below the check? A.—The checks are put in the most convenient place for receiving the water from the injector. They will pass the water through equally well should its level be below that of the check.

(4) A. M. S., Hornellsville, N. Y., asks:

What is the best thing to be done in case an engineer finds that the crown sheet of a firebox or furnace has become overheated? A.—Smother the fire by throwing earth, cinders or fine coal upon it. Do not touch the safety valve or disturb the boiler until it cools down sufficiently to throw water upon the inert mass covering the fire.

(5) J. H., Bathurst, N. S. W., writes:

We have two firemen on the Baldwin consolidation engines running over some parts of our road, and it is said that this is the only country in the world where two firemen are used on one engine. Please say if our belief in this respect is correct. A.—No; it is not correct. There are quite a number of heavy freight engines running in the United States and Canada that have two firemen.

(6) A. Y., Omaha, Neb., writes:

I often see in engineering papers the term "Mariotte's law." If it would not take too much space or work, I should be under obligations if you would explain the meaning of the term. A.—What is known as Mariotte's or Boyle's law relates to the expansion of gases. These investigators found out about the same time that the pressure of a gas varies inversely with the volume. That is to say, if you have a cubic foot of gas with 2 pounds pressure and you compress it into 1 foot, or half the volume, the pressure will be 4 pounds.

(7) Ç. A. R., Buffalo, N. Y., asks:

Is it possible to design a link motion which will reduce the lead as the links are drawn up? A.—Yes. With a locomotive and other engines with indirect motion the eccentric rods are open when the crank pin is on the forward center. If the valve motion is planned so that the eccentric rods are crossed when the crank pin is in the forward center, the lead will decrease as the links are drawn up. Full particulars can be found in Halsey's "Locomotive Link Motion."

(8) Student, Pittsburgh, Pa., writes:

Suppose there is a water tank of certain capacity supported by columns that have no more than the proper margin of strength. Now the company proposes to put up another water tank which will be twice the size of the old one. Will doubling the size of the columns be sufficient to carry the weight? A.—By doubling the size of the tank you increase its capacity eight times, while doubling the size of the columns would only increase the strength four times. So it would be necessary to increase the dimensions of the columns four times.

(9) B. W., Lincoln, Neb., asks:

What is the difference between an automatic cut-off engine and one that is not automatic? A.—An automatic cut-off engine has the cut-off operated by the governor. In the older types of steam engines the speed was regulated by the governor operating upon the throttle valve; in the modern engine the speed is regulated by the governor changing the point of cut-off. In a non-automatic engine the movement of the valve is changed by the engineer in charge moving some valve connection, which shortens or lengthens the travel of the valve or otherwise delays or accelerates the periods of cut-off, etc.

(10) W. G. R., Calistoga, Cal., writes:

Please answer the following questions and oblige a constant reader: 1. What will be the result if you reverse your engine while going at high speed, with throttle and cylinder cocks closed? A.—1. We would not predict positively, but we are inclined to think that the cylinder heads might be knocked out. 2. Is it possible for a piston valve to lift? If not, suppose you have an engine with piston valves and you "plug" her; will not the compression be excessive? Are there any provisions made for avoiding excessive compression with piston valves? A—2. A piston valve cannot lift. When you "plug" an engine with piston valves there is liable to be excessive compression.

(11) Old Subscriber, Cleveland, O., writes:

I find among my acquaintances a decided difference of opinion concerning the proper area for taking the pressure off a balanced valve. Some of them say that as much of the area as possible should be balanced, while others say that care must be taken to prevent the rush of exhaust steam pressure or the action of compression from lifting the valve off the seat, a thing which happens when more than 50 per cent. of the total area is balanced. We decided to ask for your views on the subject. A.—This subject was investigated by a committee of the Railway Master Mechanics' Association a few years ago, and they reported that the most common practice was to balance from 55 to 65 per cent. of the total area of the valve.

(12) W. B. S., Brooklyn, N. Y., writes:

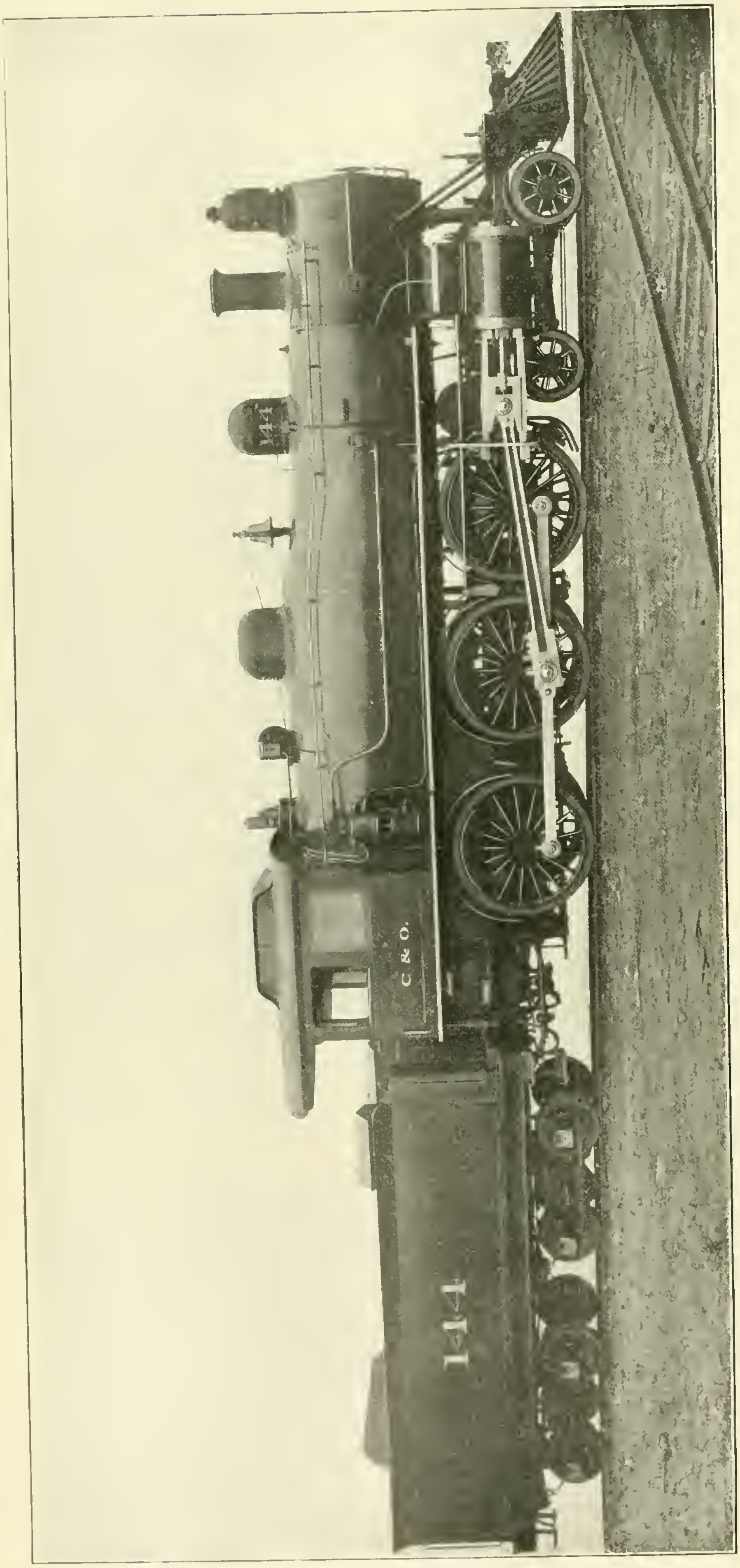
As I understand it, the factor of safety is the margin of strength between the working strain or pressure and the point where breakage or rupture is likely to happen. For instance, if you make a chain to carry 1,000 pounds safely, it must be strong enough to carry 6,000 pounds, and it is said to have a margin of safety of 6. Now what I want to know is, if steam boilers built to carry 200 pounds of steam may be depended on to carry up to 1,200 pounds before rupture takes place? A.—Your definition of the factor of safety is all right and clearly stated; but very few steam boilers have a margin of more than half 6. The steam pressure is generally calculated to be one-sixth of the strain required to rupture the solid sheets, and the factor of safety is said to be 6. But the riveted joints reduce the factor of safety nearly one-half.

(13) C. F. S., Sparks, Ga., writes:

1. What is the usual method of rating a locomotive on a hilly road? Should it be rated at more than it can start on a maximum grade under favorable circumstances? A.—1. If a grade is very long, a locomotive is generally rated to pull what it can start on the grade. If the grade is short, the engine gets a higher percentage, because momentum enables it to carry the train over the summit of the grade. 2. What is the usual maximum cut-off of freight engines in making pull over long grades? A.—2. Just the longest that the reverse lever enables the steam to follow to. 3. From the mechanical standpoint, how is an engine worked to get along with the least amount of repairs and supplies? A.—3. If you were to work an engine along with one car all the time at a very moderate speed, the repairs and supplies would be exceedingly light, but locomotives are not put in service with a view of keeping the cost of repairs and supplies at the lowest possible limit. They are used to pull the heaviest trains they possibly can, consequently they are worked as near as possible to the limit of their capacity.

(14) J. D. writes:

1. In the Sellers 1876 injectors you will notice that right below the top stud which connects the two parts of the injector, that there are two holes between ⅛ and 3-16 inch in diameter, one right by the joint of the two parts, and the other on the inside of cylinder. Will you please explain their use, and what would happen



BALDWIN EXPRESS TEN-WHEELER FOR THE CHESAPEAKE & OHIO.

if said holes were to be plugged up? A.—1. These communicate with the air chamber in the top of body. This chamber forms a cushion for the combining tube and prevents it slamming back and forth. 2. Engineer reports Sellers 1876 injectors working O. K. while standing, but when running they keep "flying off" or "breaking." What would likely be the cause of trouble? Tank was full of water. A.—2 There may be many reasons for this. The holes being plugged, as suggested above, would cause the combining tube to slam and might break the jet. Tender hose may kink when running and be all right standing. A slight leak may develop at the joints in running from the strain between injector at pipes or the tubes may be filled or worn to the critical point, so that the jar breaks the jet. These are by no means the only possible causes, but a few of them.

Baldwin Ten-Wheel Express Engine for the Chesapeake & Ohio.

The annexed illustration shows one of a group of very powerful passenger ten-wheelers recently built by the Baldwin Locomotive Works for the Chesapeake & Ohio Railroad. The cylinders are 22 x 28 inches, and drivers 72 inches in diameter, outside the tires. The total wheel base is 26 feet 6½ inches, and the driving wheel base is 14 feet 3 inches. The engine in working order weighs 173,000 pounds, of which 126,200 rests on the drivers. The boiler is 66 inches in diameter at the smallest ring and has 360 tubes 2 inches in diameter and 15 feet long. The firebox is 121⅝ inches long and 41 inches wide. The total heating surface is 3,000 square feet, of which 2,809.5 square feet are in the tubes and 191.5 are in the firebox.

We have with pleasure to acknowledge the receipt from the passenger department of the Lake Shore & Michigan Southern of a beautiful illustrated Christmas number of a Book of Trains. It contains a well selected assortment of Christmas literature, including an interesting history of Christmas, which few people are acquainted with. "Christmas Usages in Europe," "Christmas Day in Our History," and other attractive things of a similar nature follow. All are finely illustrated and are worthy of the cover, which is a reproduction of an ancient carving showing the shepherds attracted by the Star of Bethlehem. That is bordered with holly branches and their red berries. Any of our readers anxious to secure this pretty souvenir of Christmas should apply to Mr. E. J. McMahon, manager advertising department, Lake Shore & Michigan Southern Railway, Cleveland, Ohio.

There is a yard conductor on the Baltimore & Ohio at Pittsburgh named George Artz, who is 6 feet 6½ inches high.

Brooks Express Engine for Chicago & Alton.

The eight-wheel passenger engine here shown is one of an order for twelve under construction by the Brooks Locomotive Works for the Chicago & Alton Railroad Company. The engine weighs 139,000 pounds, and has 90,500 pounds on the drivers and 48,500 pounds on the engine truck. The total wheel-base is 24 feet 10 inches, of which 8 feet 9 inches is driving wheel-base. Over all the engine measures 64 feet 3⅜ inches. The boiler, which is of the improved radial stay wagon type, is 8 feet 11½ inches above the rail. There are 2,179 feet of heating surface, 2,002 of which are in the tubes and 177 square feet in the firebox. The grate area is 31.8 square feet. The drivers are 73 inches diameter, with cast-steel centers made by the Pratt & Letchworth Company, of Buffalo. The driving axle journals are 9 x 12, with enlarged wheel fits. The boiler is designed to carry a working pressure of 210 pounds per square inch. The truck journals are 6 x 12, the main crank pins 6 x 6, coupling pins 4½ x 4, and the main driving wheel fit is 6⅛ inches diameter. The cylinders are 19 x 26 inches, main rod 105 inches long between centers. The valves are of the improved piston variety, and have steam ports 21½ inches long by 2 inches wide. There are 50 square inches of exhaust area. The width of the bridge is 3¼ inches. The engine has about 23,000 pounds of tractive power, and has a ratio of adhesion to tractive power of about 4. The valve has 1⅛ inches steam lap and has 6¼ inches maximum travel. The boiler is 66⅛ inches diameter at the smallest ring and is made of steel varying in thickness from ¾ to 9-16. There are 306 2-inch tubes, which are 12 feet 7⅜ inches long, and are set with a pitch of 2⅞ inches from center to center.

Among the special equipment specified are the Westinghouse high-speed brake, with 50,000 cubic inches reservoir; American equalized brake on back of drivers and American engine truck brake. The pump is the largest sized, 9½ inches. Detroit sight-fed lubricators are used, Kunkle safety valves, Hancock composite injectors, French springs, Jerome metallic packing, Pyle electric headlight and Sargent brake shoes.

BROOKS CHICAGO & ALTON EXPRESS TRAIN.

Shortcomings of the M. C. B. Coupler Knuckle.

At the December meeting of the Western Railway Club the first paper was on "Patents; What They Are Not," by Paul Synnestvedt, of Chicago, in which was explained some of the uses and abuses of the patent laws. A communication from Mr. J. Snowden Bell, on some features of the patent law, was read by the secretary. The subject was briefly discussed by the members.

The paper read by Master Mechanic Luttrell, of the Illinois Central Railroad, on the weakness of the knuckle of the Master Car Builders coupler, and recommending that the link-slot and pin-hole be closed up, was thoroughly discussed. Mr. Luttrell stated that about 60 per cent. of the couplers failed in one or the other of the lugs, and 11 per cent. additional failed from some other part of the knuckle giving way, leaving only 29 per cent. of the breakages which disabled the coupler, to the other parts. Of all the couplers in service about 9 per cent. gave out in various places. Mr. Luttrell recommends that as soon as the Interstate Commerce law in regard to the exclusive use of the couplers goes into effect, that the slot and pin-hole be at once closed up. This would add about 9½ pounds to the weight of the knuckle which would have to be paid for; but the saving in breakage would greatly diminish the annual cost, as well as increase the wear of the knuckle.

Mr. Sullivan, of the Cloud Steel Truck Company, stated that when he was connected with a malleable iron company, it was suggested that the slot and pin-hole be closed up in the knuckles of the couplers used on the locomotives of a certain road. It was done, and such good results followed that the knuckles used on cars that did not go off the home road were also thus equipped. He agreed that there will be no use for the link-slot after all cars are equipped with the Master Car Builders couplers, but that there might be trouble in coupling and moving cars on sharp curves, in which case a link coupling or its equivalent would be necessary.

Mr. P. H. Peck, of the Chicago & Western Indiana Belt Railway, spoke in the same strain, and added that a great many lugs are broken off knuckles by coupling high and low cars together which would be helped out by a solid knuckle.

Mr. R. D. Smith, master mechanic, Chicago, Burlington & Quincy Railroad, said he favored closing up the link slot and pin-hole and making some other arrangement for coupling cars to get them around sharp curves in yards.

Mr. Street favored closing the link slot and leaving the pin-hole, in which case an ordinary link could be used on top of the knuckle.

Mr. R. D. Smith said a boss or lug could be put on top of knuckle for use in such emergencies.

A communication was read from Mr. G. W. Rhodes in relation to this subject. He recommends closing up the opening in the knuckle at once to not over $1\frac{1}{4}$ inches. They began this plan something over a year ago on the knuckles used in their way cars and were pleased with it; so far had heard no complaints from the train men. Referring to the idea advanced, that the knuckle should have a large slot in it to accommodate the push-bars used on engine pilots, he said that this type of engine coupling was so dangerous that no concessions should be made for it; it was unlawful to use it. He recommends the plan of closing up the slot and pin-hole as soon as the time limit set by the Commission expires.

Mr. B. Haskell, superintendent of motive power, Chicago & West Michigan Railway, commends the plan, and spoke of the need of some device to couple cars on sharp curves.

President Hetzler agreed with Mr. Luttrell, that the slot and pin-hole should be done away with and some other provision be made for coupling on sharp curves, etc., to get cars moved from warehouses and in yards.

Mr. A. J. Scheevers, of the Janney Coupler Company, commends the plan. They now have knuckles with a lug swaged on the top for this purpose. Closing up the knuckle adds 25 per cent. to its strength, and he thinks now is the time to begin the reform. He was glad that the Western Railway Club had taken the matter up. He stated that the use of a link in the knuckle broke more of them than anything connected with the design of coupler.

Mr. Geo. H. Brown, master mechanic, Chicago, Milwaukee & St. Paul Railway, stated that the discussion of this subject was opportune; that when the link and pin coupling leaves us the slot and pin-hole will disappear. Knuckles should be hardened on their wearing face to reduce the wear.

The consensus of opinion from those who spoke on the subject was in favor of beginning to do away with the link slot and pin-hole as soon as possible.

We have no doubt that if the inventive genius which has run to car couplers is turned to getting out some device for attaching to one knuckle to couple to another knuckle and allow slack for the sharp curves found near shops, warehouses, etc., that there will be remedies enough for this trouble.

A word to car-coupler men is enough to start such a movement in order to improve their devices already on the market.

The American Steam Gage Company, Boston, Mass., will move from their old quarters on Chardon street to Boylston street, Jamaica Plains. This gives them more than double their present capacity, and has been made absolutely necessary by the growth of their business. Those who are familiar with the merit of their gages and valves will have no difficulty in accounting for this growth.

About Station Signals.

Since railway companies have begun to become prosperous enough to spare money for improvements, we notice that a great many of them are extending their system of fixed station signals. Where this is done it is very necessary that trainmen should make themselves familiar with the details of the system that has been installed. We have in this office a book on "Block and Interlocking Signals," which is of invaluable assistance to those desiring information regarding signals and interlocking switches. The book is of considerable size, and deals comprehensively with the subject of signals, telling what they are for, what they do and how they do it. It is the most complete book of its kind ever written, and is from the pen of W. H. Elliott, signal engineer of the Chicago, Milwaukee & St. Paul. The book gives very valuable information for trainmen who want to understand their business, but for superintendents, train masters and other officials immediately connected with the operation of railways having train signals, this book is essential. It ought to be in the office of every official of that sort for reference at all times. It is in our book list for $3.

Nickel steel is slowly making its way into favor with railroad men for parts of railroad machinery that have been noted for failure. Driving axles of locomotives and piston rods are now frequently made of nickel steel, and the material seems eminently suitable for these parts. The material has been in use too short a time to demonstrate its durability, but we will have opportunities to judge of its real value pretty soon. It has been well spoken of by the Master Mechanics' Association for crank pins, piston rods, driving axles, side rods, firebox plates and staybolts. We would like to recommend that it be tried for the piston rods of steam hammers. We do not know of any service where it would be more severely tried.

The Pratt Chuck Company, of Frankfort, N. Y., owing to the large demand for their product, have found it necessary to largely increase their force, and are rebuilding and making additions to their plant, in order to meet these demands. Among several foreign orders recently received was one from one of the great shipbuilding firms on the Clyde. They are now in correspondence with one of the largest railroad systems of Great Britain, who desire to secure a chuck that will not permit the drill to slip under any conditions, that they may introduce the same in the several railroad shops connected therewith. They have already placed a trial order with this firm. They also report large increase in their domestic orders, showing that the machinists are recognizing the superiority of these chucks.

A New Engraving of Our American Locomotive Educational Chart.

One of the greatest inconveniences that we have suffered through our office being burned out a year ago last month, was the destroying of the plate of our educational chart, known as the American locomotive, or a transparency of the famous locomotive "999."

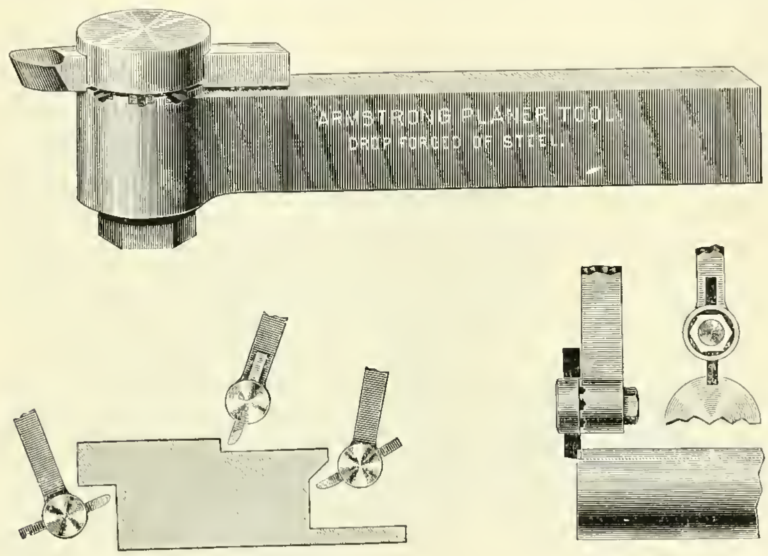
We supposed at first that the demand for this fine educational engraving had about ceased, but it seems that when people find they cannot get a thing of that sort they wax tremendously anxious to get it, and we have been flooded with applications for copies of the chart. At first we decided not to reproduce it, as the engraving is very costly, but the demands have increased so much that we have finally decided to make a new engraving, and it is now well under way. We therefore wish to make the announcement that within a few weeks, at the latest, we will be in a position to send the engraving to anyone who wants it.

Ventilator for Electric Headlights.

A very serious annoyance connected with the use of electric headlights has been the breaking of the glass in front of the case, supposed to be caused by the heat of the arc light which does not heat up the thin sheet of glass evenly. To remedy this the glass has been set out in the front of the case farther from the arc; in other cases the glass has been set in strips, which reduce the inequality of the expansion, as well as allow air to pass through between the strips in a slight degree; while still others use a special convex glass, which is expensive.

Master Mechanic Tracey, of the Southern Railway, at Atlanta, Ga., puts in a ventilator, which tends to keep the glass cool inside and save breakage.

We understand that the device is patented.



ARMSTRONG PLANER TOOLS.

Armstrong Planer Tool.

The engravings here shown illustrate the Armstrong planer tool which is very popular with shop men on account of its many advantages over the ordinary tool. The illustrations are so plain that no special description is necessary. One of them shows the tool at work on close corners, for which it is eminently suited, and gives a good idea of the clearance obtained. It shows also a few of the angles at which the cutter can be set. A job similar to the one shown could be finished with the Armstrong planer tool without shifting position of the work.

Fig. 2 shows the Armstrong planer tool cutting a keyway with the cutter reversed and the tool turned around, thus throwing the cutter point behind center of tool and practically working as a "goose-neck" tool.

Illinois Central Improvements.

At Louisville, Ky., the Illinois Central Railroad Company have just completed a new brick roundhouse with fifteen stalls, which will take in the longest locomotive the company has in service and have room to spare at each end. The pits have brick sides and concrete bottoms. They are steam heated and exceptionally well drained.

There are two drop pits equipped with hydraulic jacks. One of them is large enough to take out a pair of driving wheels or an entire truck. The other pit is for changing a single pair of truck wheels. All the appointments of the building in the way of washing out, steam and air pipes are very complete. The Bristol fire-kindler will be used for lighting up engines. A compressor of ample capacity is to be installed in the engine room.

A machine shop, 50 x 75 feet, is going up. It is to be equipped with two lathes, a planer, a shaper, drill press, bolt cutter, etc., suitable for doing light repairs.

The oil-house is brick, with concrete

floors. The oil is stored in underground tanks and raised with air pressure to the supply room. The second floor of the oil-house is for a storeroom.

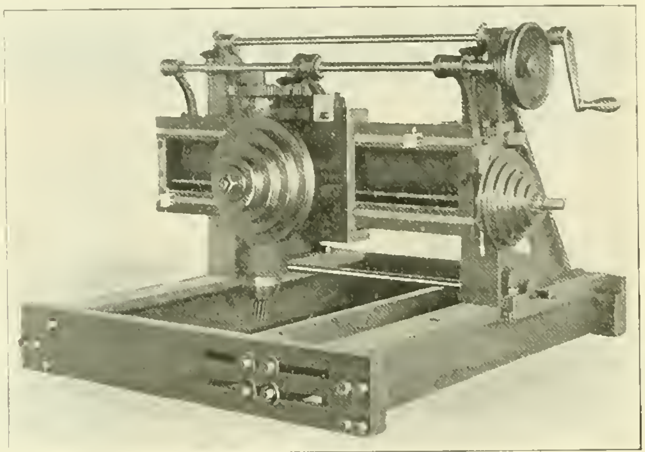
Electric lights will be used everywhere, both in the buildings and in the yard.

The cinder pit has a set of large buckets to receive the ashes, which will be raised with an air hoist and dumped into gondolas on an adjoining track. Coal is also handled with an air hoist and derrick, using buckets.

Mr. H. C. Eick is in charge as general foreman.

A Cylinder Port Milling Machine.

A recent visit to the shops of Beaman & Smith, Providence, R. I., disclosed a novel machine for milling out the ports of a locomotive cylinder. It is a very compact machine, light enough to be handled by four men if a crane is not available, as it only weighs 650 pounds, and has the advantage of going to the work instead of taking the half saddle and cylinder to a machine. It also has a record for fast work that cannot but commend it to every shop handling new cylinders. It has all requisite movements, ample power to do the work, and can be readily attached to any standard locomotive cylinder. The frame or bed is fastened to the steam-chest seat of the cylinder using the bolt holes for that purpose. The uprights are moved on the frame by means of racks and pinions until the milling cutter is over the ports as desired, and are then securely fastened to the frame. A graduated scale let into the side of the frame facilitates accurate measurements.



PORT MILLING MACHINE.

The crosshead carrying the spindle is lowered similar to that of a planer until the milling cutter is at the required depth, and then securely fastened to the uprights. The spindle is of steel, of large diameter and runs in conical bronze bearings with adjustment to compensate for wear, and is driven by a cone having four sections for a round belt or rope through gearing, the cone making eight turns to one of spindle.

The feed is 20 inches, and automatic in either direction, is driven by a cone having five sections, and can be stopped automatically as required.

Cooling Device.

The Nashville, Chattanooga & St. Louis Railway use a great deal of compressed air at their main shops in Nashville, as well as in the pneumatic interlocking switch machines in the yards there. If the water which is freed after compression is not all separated from the air before it goes to the machines it gives lots of trouble.

To obviate this trouble the delivery pipe from the compressors passes through the water tank, using a long coil in the bottom of the tub, which cools off the air completely, and the water remains in the main reservoirs when it arrives there. There is a very large storage capacity, so that sudden fluctuations in the air pressure do not affect the work of the machines.

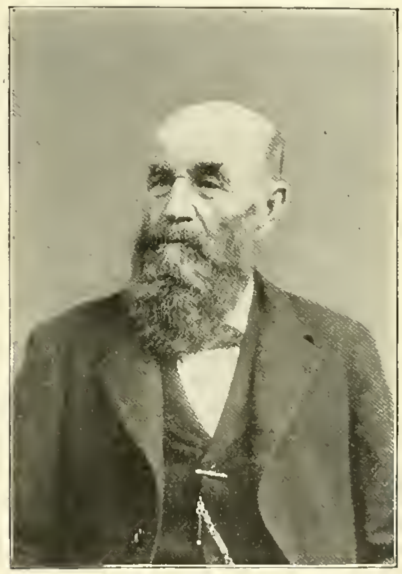
The main air pipe, running from one building to another and to the testing yard for freight cars, is 2½ inches in diameter. This large size gives an idea of the amount of air used and the equal pressure at all points.

There is said to be a natural barometer on the line of the Ontario & Western Railroad near the Delaware River. When a storm is brewing, the sounds are heard so distinctly in a hollow by the side of the river that the movement of trains can be heard distinctly eight miles away. The sound of railroad trains has taught a great many people that noises are heard farther when the barometer is low, which indicates low atmospheric pressure, than at other times. That condition is conducive to the easy passage of sound vibrations through the air.

Samuel G. Nicholson Retires.

Samuel G. Nicholson, of East Bridgeport, Conn., after a service of fifty-two years on the railroad, has severed his connections, and will hereafter enjoy the fruits of his labor of past years in his old age.

Mr. Nicholson was a man who took good care of himself as well as his money. He was always good to everybody in need, and had a good word for everyone. He entered the employ of the Boston & Albany Railroad as brakeman in 1847, and remained with them until 1854, when he entered the service of the Housatonic Railroad, now the Berkshire division of the New York, New Haven & Hartford Railroad, as fireman, and from his close attention to his duties he was promoted in 1856 to engineer, and has run continuously since then until December, 1899, when he resigned, to the surprise and sorrow of all who knew him, as the boys all thought that Sam would spend his last days on the road, for it is hard work for a man who has been railroading as long as he has to leave it; but Mr. Nicholson leaves the service of his own free will, thinking it about time to retire for a man of his age, and having amassed enough to keep his family in comfortable circumstances.



SAMUEL G. NICHOLSON.

Although seventy-two years of age, Mr. Nicholson retains all of his faculties, and can boast of having keener eyesight than the average man half his age, having only recently passed a first-class examination. At his retirement he was complimented on his long and successful railroad career. During his life as an engineer he has been down the banks three times, escaping injury each time, although he stuck to his post each time, and was in no way to blame for either of the accidents. Some of his early experiences in railroading, if printed here, would make very interesting reading.

Locomotive Building in 1899.

One of the most prosperous industries in the United States during the past year has been that of building locomotives. There are twelve establishments in this country engaged in the building of locomotives, and reports received almost up to the last day of December enable us to report that 2,396 locomotives were built in the works referred to during the past year. Railroad companies, as a rule, do not follow the practice of building their own locomotives, but one road has works devoted entirely to locomotive building and quite a number of railroad companies construct a few engines annually to keep tools and men busy when repair work is slack. From information that has come to us, we estimate that railroad companies have built 124 engines during the year. With those turned out by the builders this makes a total of 2,520, which is the largest production of locomotives in one year during the history of the country. We estimate that 10 per cent. of the locomotives built in contract shops were for export beyond the seas, those built for Canada and Mexico being regarded as domestic.

The most conspicuous feature about the locomotives built during the year has been the enormous increase in weight and power. The tendency of designers is to make the engines as powerful as they can be built within the limits of track 4 feet 8½ inches wide and bridges 15 feet high. The tendency prevailing is to equip locomotives with a great many expensive attachments designed for increasing the safety of train operating and the convenience of the enginemen. Among these may be mentioned air brakes, train signals, heating apparatus, cylinder lubricators, elaborate injectors, expensive safety valves, automatic sanders, automatic blow-off cocks and many other things that were regarded as novelties only a few years ago. That serves to greatly increase the selling price of a new locomotive. Taking the light and heavy locomotives built during the year, it is safe to conclude that the average price was not less than $10,000 per engine. This makes a grand total of $25,200,000.

The following are the number of locomotives built during the last ten years, the first nine years being taken from reports collected by the *Railroad Gazette:*

1890	2,240	1895	1,101
1891	2,165	1896	1,175
1892	2,012	1897	1,251
1893	2,011	1898	1,875
1894	695	1899	2,520

The Union Pacific shops at Omaha have a transfer table which is operated by a small Westinghouse engine that had become too small for the work it was originally installed to do. It moves the transfer table very expeditiously, and practically demands no attention. It has been working for years without any repairs.

Extension of Time for Equipment of the Safety Appliance Law.

It has been apparent for several months that many railroads would be away behind in equipping their locomotives and cars with safety appliances when the law making the use of such appliances compulsory went into effect on January 1. A few railroad companies had done everything required by the law and were ready to meet its provisions, but by far the greater number of our railroad companies were away behind, and some of them had acted as if they expected that there was no intention of putting the safety-appliance law into force.

A hearing was given last month by the Interstate Commerce Commission to representatives of the railroad companies who desired a further extension of the time within which to comply with the provisions of the Safety Appliance act. Representatives of railroad employés were also permitted to give evidence as to the position the men engaged in train service were likely to take upon the question of extending the time for the enforcement of the act, which was primarily intended to prevent the killing and maiming of people engaged in the moving of surface railroad cars. After listening to the opinions and arguments presented, the Interstate Commerce Commission have decided to extend for seven months the time previously agreed upon for the enforcement of the act.

In commenting upon the progress made in equipping railroad locomotives and cars with safety appliances, the Interstate Commerce Commission says:

"Recent investigations, undertaken by the Commission of its own motion, have developed the fact that these automatic couplers, and the attachments designed to render them automatic, although placed upon the cars, are not always kept in such condition that they couple or uncouple automatically. They are often suffered to remain out of repair, so that it is necessary for brakemen to go between the cars for the purpose of coupling or uncoupling. It constantly happens, too, that they are used in connection with the old-fashioned link-and-pin coupler, and it is an undoubted fact that when what ought to be an automatic coupler ceases to be such, or when it is used in connection with the link-and-pin coupler, the hazard to the train man is greater than it would be were all cars equipped with the link and pin. Now, the prohibition of the law is against the using in interstate commerce of any cars which will not couple and uncouple without the necessity of the employé going between the ends of the cars. Until all cars, practically, are equipped with such couplers, and until those couplers are kept in repair, it is manifest that those which are placed upon the cars are a menace rather than a protection to the men."

That indicates that the Interstate Commerce Commission have taken the highly sensible position that not only must safety appliances be put upon the cars, but they must be maintained in working order. Many railroad companies display scandalous carelessness about the maintenance of safety appliances, and it is notorious that a large number of the cars having automatic couplers and air brakes might as well be without them, so far as the safety of the men operating them is concerned.

While they are in the mood of investigating the condition of railroad safety appliances, we would respectfully direct the attention of the Interstate Commerce Commission to the prevailing condition of automatic brakes. There are several things in this connection that ought to be thoroughly investigated. Those interested in the safe operating of railways would be interested in knowing what percentage of cars in interstate trains equipped with air brakes have the brakes in a condition to help in stopping the trains. When this information is ascertained, it will astonish a great many people who think that applying a safety device ends the source of danger. If that line of investigation is properly carried out, the public will learn that a safety appliance on a car is a positive source of danger if it is not kept in working order.

In connection with investigating the subject of automatic brakes, it would be interesting to let the people know how far the various makes of brakes in use are arranged to work in harmony. We have frequently heard the assertion made that certain triple valves, if present on a train equipped with other triple valves, would prevent the engineer from making a service stop. It is said that no matter how gentle the brake application might be, this triple would let out air enough to cause emergency action of all the other triples. That is a dangerous feature, if true, and ought to be properly understood, so that the brakes on such cars could be cut out in time to prevent accidents.

The continuous advancement of the American railway is exhibited by the fact that, less than a quarter of a century ago, the capacity of a freight car upon the average railroad was 20,000 pounds, while the capacity of a freight engine was from twenty to thirty of such cars to the train. To-day on the New York Central, whose tracks run alongside the Erie Canal for the entire distance from Buffalo to Albany, the capacity of the grain cars is from 60,000 to 66,000 pounds, and a locomotive of the latest type will haul from seventy-five to ninety such cars loaded full. It is not an infrequent occurrence for a single engine to haul through the Mohawk Valley, beside the Erie Canal, 85,000 to 90,000 bushels of grain in a single train; the same engine will haul from 110 to 125 empty cars.

Pensions for Faithful Employés.

Old age pensions for faithful employés who have become incapacitated for work are to be established by the Pennsylvania Railroad Company at the beginning of this year. The full details are not obtainable, but ample provision is to be made for all. This is the first great corporation to undertake such work, and its operation will be watched with interest.

It is not likely that sentimental reasons have dictated this policy, though corporation managers are not always without souls. More likely the company has figured out that the pension plan is a good paying investment, because it insures more faithful service on the part of all of its great army of employés.

The Pennsylvania Railroad has a great reputation among railroad men for its strictly merit system. Every one of its officers has risen from the ranks, and men trained in its system are occupying prominent positions on roads all over the country. If the new plan is successful it will undoubtedly lead other corporations to follow in its steps. It is a noble work, whether it is a selfish one or not. Such a policy universally undertaken would relieve the world of much of its misery.

Examining Piston Packing.

One of our subscribers, whose specialty is cylinder lubrication, and who has seen the packing examined in hundreds of locomotive cylinders on various roads, gives it as his opinion that cylinder packing should be examined at regular intervals, just the same as any other part of the engine that is subject to breakages.

When piston packing and the fit of the rings in the cylinder are not examined till it begins to blow, there is damage enough done to pay for making a number of examinations that find the packing in good order. Rings get broken and do not blow very badly, but the engine will not do as much work with a ton of coal or tender of water as when the packing rings are in first-class shape. To keep the engine at the best point of her efficiency, we believe regular inspections of packing should be made. If rings are found broken or worn out when examined, reduce the interval between inspections so as to find them out when first out of order. They do not always blow when first broken.

Traveling Engineers Want Information about the Steam Engine Indicator.

One of the subjects for discussion at the next meeting of the Traveling Engineers' Association is "The Use of the Steam Engine Indicator as an Aid to the Traveling Engineer to Determine the Efficiency of the Locomotive in Service, and the Benefits Derived Therefrom," and the chairman of the committee having this subject in charge, Mr. George Wildin, of the Plant system at Savannah, Ga., is already out with a list of questions bearing on the subject.

If traveling engineers and others who are in charge of the operation of locomotives were more familiar with the use of the indicator and the results obtained, it would be more generally relied on for making tests.

The object of this committee is to obtain as many facts as possible, and it will be a favor to them if those who use indicators in locomotive work will send samples of cards, with the deductions worked out, to the chairman. This is not to be confined to members of the association, but to all who are interested.

The Baltimore & Ohio Railroad have just placed an order for 43,500 tons of 85-pound steel rail for delivery in 1900. The order has been divided, the Carnegie Company getting 26,000 tons, the Maryland Steel Company 5,000, the Cambria Steel Company 5,000 and the Federal Steel Company 7,500. The contract price is about $33 per ton, or 87 per cent. more than the receivers paid for rail during the time they had charge of the property. Of the total amount just ordered the Baltimore & Ohio proper will get 26,000 tons, the Baltimore & Ohio Southwestern 12,500, the Pittsburgh & Western 4,000, and the Cleveland Terminal & Valley 1,000.

A great many street cars have recently been equipped with Gold's improved electric heater, and it is reported to be one of the most efficient methods of car heating ever introduced. There is a coil set beneath each seat, and it produces an evenly diffused heat which is highly comfortable to passengers. It is in very compact form, with nothing to get out of order, and is one of the kind of car equipment that gives no trouble to those in charge, while performing its duty in the most satisfactory manner.

We are informed by the Q & C Co. that the litigation on pneumatic tools which has excited a good deal of attention lately does not concern them. They say that the line of tools manufactured by them are protected by patents unique and broad in themselves, and absolutely clear from any infringement of others, and full protection will be given to any purchaser of the Q & C tools from any liability on account of their use.

The cipher code issued by the Freight Claim Association, prepared by the committee on uniform blanks, adopted at the eighth semi-annual meeting, October 5, 1899, gives the cipher word "Renowned" to represent the Lehigh Valley Railroad.

The bargain counter is not in it with our offer of "Stories of the Railroad" and "Jim Skeevers' Object Lessons" for $2. Send in your order before the supply runs out.

Two Rand Catalogues.

The Rand Drill Company, New York, have favored us with two new books relating to their products. "Rock Drills and Drill Mountings" contains about eighty pages, showing their drills, their various mountings, and giving much information about them. The drills, special blacksmiths' tools for making and dressing them receive careful attention.

The other deals with air and gas compressors, and has about 130 pages, and both books are 6 x 9 inches. This shows their different styles of compressors, from belt to water driven, and gives tables of capacities and dimensions. There is a chapter on altitude compression, which will interest all who are located above tidewater. Both books contain useful tables relating to compressed air, and form quite an addition to a reference library. Those who can obtain copies of these new catalogues will consider themselves fortunate, and we feel sure that they will be supplied as liberally as possible.

The United States Metallic Packing Company, Philadelphia, Pa., have just issued a catalogue of locomotive packings, which is both unique and interesting. The cover shows a fine cut of the historical "Stourbridge Lion" of 1829, and the whole thing is a nice piece of artistic catalogue work. It gives the history of metallic packing for locomotives in a very readable manner, and tells how the difficulties have been overcome. Fine halftones from wash drawings illustrate the book, and make it attractive from both an artistic and mechanical point of view. We presume they will be sent on application.

The opening lecture for the coming year in the course of special railway lectures at Purdue University was given on November 28 by President George B. Leighton, of the Los Angeles Terminal Railway. President Leighton's subject was "The Work Ahead," and his talk was a brief outline of the opportunities in prospect for those entering railway work. After a short review of the notable events and inventions in railroading in the past, President Leighton discussed the lines along which the coming engineer must work and in which the chances to distinguish himself will be the greatest. The subject is an interesting one, and was ably presented.

We have a leaflet from the New York Central containing an editorial from an Albany paper, telling "What a Mogul Can Do." The article gives similar particulars which we previously published about the performance of one of the new ten-wheel engines belonging to the New York Central while pulling a train of sixteen cars. It was an extraordinary performance and well worthy to be heralded throughout the world. We are sorry, however, that they talk of the engine as a mogul. A mogul is the name of a well-known type of American locomotive which has three pairs of drivers, coupled, and a pony truck. Engines of that kind are principally used on freight service.

We have received from The McConway & Torley Company, Pittsburgh, Pa., a small booklet consisting of a catechism of the Master Car Builders' rules of interchange. There is no form of instruction so effective as a catechism, as the churchmen of the world learned a good many hundreds of years ago. The catechism of the Master Car Builders' rules is made so plain and searching that no information of any importance has been overlooked or left unexplained. We believe that this catechism will do more to make the rules of interchange familiar to car inspectors and galvanizers than all the labors previously expended in efforts to strike the vital spark of their intellectual being.

An illustrated catalogue has been issued by the Garden City Sand Company, Chicago, showing a few of the articles made in the fire brick department. Besides the illustrations, there is a great deal of useful information relating to the use of refractory substances for firebox and furnace purposes. There is also a good deal of information relating to foundry matters. Those interested in these subjects will find the pamphlet very useful.

Shickle, Harrison & Howard, of St. Louis, are erecting a new steel plant in East St. Louis, which the firm say will be the most perfect plant of the kind in the country. They turn out wonderfully fine steel castings in the contracted quarters they now occupy, and they expect that the improved facilities will not only increase the output, but also make it better.

The Missouri Pacific Railroad mechanical department, which has long been famous for the application of labor-saving devices to locomotives, has secured to all its engines a casting so made that it will take on any size of Westinghouse air pump. The company are now buying nothing but 9½-inch pumps, but they find it very convenient to have a bracket that will secure any size.

The Buffalo Forge Company have favored us with a little folder, showing some of the engines made by them. They are self-contained, self-oiling and of neat design. They are made both center and side crank, and are shown direct-connected to General Electric generators mounted on the same sub-base. They also make one specially for Westinghouse generators. Their marine type of engines are compact, convenient and well known.

Asbestos in Bearings.

In our travels around the country it is noticed that sheet asbestos is used in place of babbitt or bearing metal in bearings. The shallow recesses in crank pin and driving box brasses which were formerly filled with babbitt now have sheet asbestos pounded in solid and the surface trimmed off even with the brass, and the usual result is a cool running bearing.

Possibly the porous nature of the asbestos serves to hold the oil so as more perfectly to lubricate the journal or pin, and at the same time catch any particles of metal abraded from the journal or bearing so these particles will not get between the rubbing surfaces again.

Asbestos will not melt out or change its nature at any ordinary heat, as babbitt will. When it is packed in solid it offers considerable resistance to compression, and in this way takes a part of the load the brass has to carry.

Experience with it as an air pump piston rod packing shows that it is practically indestructible; it gets as hard as iron, but there it does not get proper lubrication and is very hot all the time, so it does not work very well.

The L. S. Starrett Company, Athol, Mass., have issued another of their interesting catalogues for machinists and draftsmen. Their tools, such as rules, squares, calipers, micrometers, etc., have become so well known as to rank high among careful machinists, and their increase of business shows that they must be perfectly reliable. They show several new tools, designed for special uses, and their improvements in micrometers will interest good machinists anywhere. We would suggest sending for catalogue No. 16 and finding out how many new tools there are in your line.

The Great Salt Lake is reported to be drying up, and some curious calculations have been made as to the quantity of salt that will remain there after the bed becomes perfectly dry. One writer, for example, has estimated, this year, that the quantity of salt is nearly nine billion tons, and that it would take a freight train carrying all this salt and running at the rate of twenty miles an hour day and night, 28 years 5 months and 23 days to pass a station. This writer's bent for figures will prove his undoing if he gives it full swing. It is better to accept the more conservative calculations of scientific men, who estimate that the waters hold about four hundred million tons of common salt. Accepting this estimate as approximately accurate, every other source of salt pales in comparison with the riches Great Salt Lake will offer if its waters disappear, leaving the mineral more easily and cheaply accessible, as it will be, than in any other salt mines or evaporation grounds of the world.

Prayer of the "Chain-Gang" Loco.

A "chain-gang" loco. once made her prayer,
As she stood in her roundhouse stall,
Brooding o'er days, dear bygone days,
The dearest to her of all.
When oil was plenty and waste was free,
And engines were single-crewed all.
She thought of the ways of the dear old days,
Standing there in her roundhouse stall.

"Oh! thou, good boss wiper," she softly prayed,
"First on my list of all,
Just one good cleaning of the good old kind
As I stand in my roundhouse stall.
The cinders and dirt my bearings hurt,
And my guides cut worst of all.
My pins run hot, and I'm a sorry pot,
Standing here in my roundhouse stall.

"Oh! thou, good machinist," she humbly spake,
"Next on my list of all,
I pray you close that main rod brass
As I stand in my roundhouse stall,
Lest the thump and the pound, as the wheels turn round,
May cause my stack to fall.
I'm slurred 'Old Scrap' and called 'Rattle-trap,'
As men pass my roundhouse stall.

"Oh! thou, good boiler-maker," she whispered low,
"Before you I humbly fall.
Pray calk my flues and give me an arch
As I stand in my roundhouse stall.
Scrape off my sheet, so that the heat
May be at the engineer's call;
And bore out those flues that I cannot use,
Even here in my roundhouse stall.

"Oh! thou, master-mechanic," she softly prayed,
"Before you I grope and crawl.
Half my life I'd swap for ten days in your shop,
To stand in a back shop stall.
I'd have new shoes, new wedges, new flues,
With fresh paint I'd be clean as a doll.
And a good square exhaust with none of them lost,
I'd take from my back shop stall.

"Oh! thou, good yard-master," she loudly cried,
"Thou greatest man of all,
Just one less load o'er this hilly road,
I pray from my roundhouse stall.
Then no more I'll trouble the dispatcher to double
The hills so well known to us all.
Grant me these, oh! then, and I'll say Amen!
From the depths of my roundhouse stall."

—*Fred M. Nellis.*

The Hancock Inspirator Company, of Boston, Mass., announce that they have no agents and sell their apparatus direct to the trade. They say that the Hancock inspirator has always been manufactured by the company, but for a number of years was sold through parties acting as sole agents. That agency has now been terminated.

Some of the outside equalized brakes built by the American Brake Company for the large engines put in service during 1899 weigh 4,000 pounds without the brake cylinders and auxiliaries. Just think of it—two tons of brake gear to hold one of the modern engines! This may be all right for engines that are deficient in weight on their drivers, and there are a great many of them, but it is wretched engineering.

CONTENTS.

INDEX TO ADVERTISEMENTS.

Locomotive Engineering

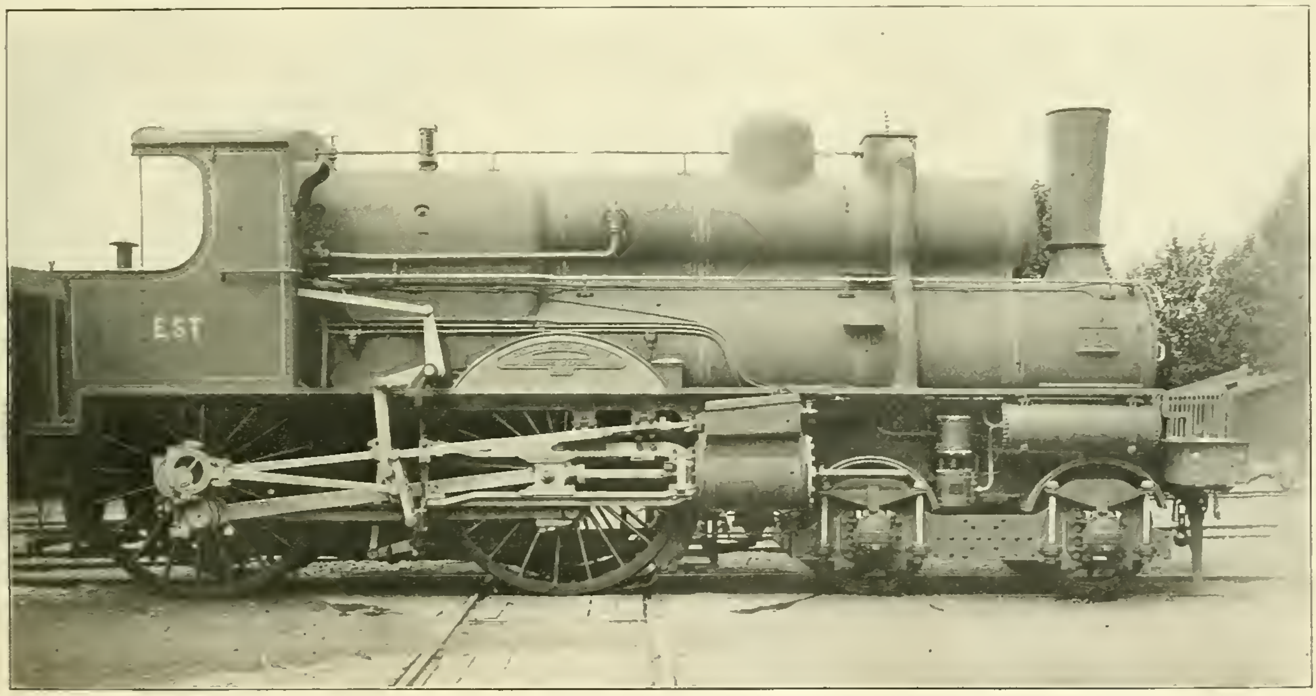
A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII | 95 Liberty Street, New York, February, 1900 | No. 2

French Four-Cylinder Compound.

These engines were designed by M. Salomon and built at the company's shops at Epernay, France. As will be seen, it has a double-barrel boiler, known as the "Flaman" boiler. The firebox has 26 square feet of heating service, and the boiler a heating surface of 1,810.9 square feet.

The upper barrel is 31½ inches and the lower 46 inches in diameter. The lower one contains 304 tubes with an outside diameter of 1.58 inches. The driving wheels are 82¼ inches in diameter. The engine weighs 125,000 pounds, of which about 75,000 pounds are on the drivers. They have shifting link, steam sanders and automatic air brakes.



FOUR-CYLINDER COMPOUND FOR EASTERN RAILWAY OF FRANCE.

In spite of the extra large edition of January—25,000 copies—they were all gone by the tenth of the month. Shows how a good thing is appreciated; but we are sorry to disappoint so many who wanted to commence with January. It is very difficult to gauge the demand for any kind of publication, as some editions go out of print long before others, without any apparent reason. We'll be all right on the rest of the year, though, so don't hesitate on that account.

Work Report Books.

The work report book, as it is usually kept at most roundhouses, does not always serve the purpose of a legal witness and tell the truth, the whole truth and nothing but the truth. Its record, of course, tends that way more or less, as the engineers, inspectors and repair men attend to their various duties.

A common form is a blank book of convenient size, in which is recorded by the man who made the inspection on arrival the various ailments of the locomotive. Sometimes a date is entered; at other times it is not. When the foreman in charge of the repairs looks the report over, he runs his pencil through such items as he does not wish to have attended to for that trip. In other cases the repair man works out some more of the items which he considers in shape to make another trip, and marks out in the same manner such work as he attended to, so that there is no exact record as to just what was done in the way of repairs.

There might have been a time, years ago, when a work report book was only required as a means of informing the foreman or repair man what the engineer wanted done on the engine; but that day is past. Now it should be used as a record of the condition of the entire machine on arrival, and a notice of the defects and disabled parts which need attention before another trip is made. This is necessary to protect the employé, whether an engineman or a repair man, by giving a detailed account of the work needed. The book should show just what work was marked out by foreman as not to be done at that time, and what repairs were made and by whom. Where the clerical force does not take care of the reports of work needed and work done on each engine, the book should have the work needed on one page—usually the left-hand one. The other page should have the notice from foreman to pass any work signed by his initials, as he should take this responsibility, with a report from the repair man as to what he did. On some roads, the time at which the work was finished is also noted. This last is of importance when fixing the responsibility for delays.

It is growing into favor where engines are pooled, to have the engineer make out a work slip on a printed form, on which is noted any defects he may have noted, either on the trip or at the inspection at the end of the trip. This includes all defects of engine not steaming, valves or piston packing blowing, pounds in rods and boxes, defects in injectors, grates and boiler. He can note these troubles better than the inspector, who does not hear or see the engine at work, and therefore has a poor chance to locate blows and pounds.

An outgoing engineer should be required to inspect the work report book, when he takes the engine, if possible to do so, so that he will have an idea of possible troubles with the engine on the trip. The record of this book is needed whenever legal contests come up, involving the responsibility of either employé or company, and it serves a valuable purpose if kept right. If it is done in a slipshod manner, verbal reports to the foreman are of just as much effect.

A Little About Injectors.

C. B. CONGER.

One of the boys who has attended all our meetings held in 1899 writes me to talk about locomotive injectors this time, asking quite a list of questions. The first one is: What gives an injector its power to throw water against the pressure in the boiler supplying the injector with steam? followed by: Does the steam condensing in the combining tube and forming a vacuum have anything to do with the work? Why won't it work hot feed water as well as cold? How much higher pressure than the steam has will it work against? Lastly, Why won't it work when the tubes get cut out with gritty water or scaled up with lime?

These inquiries we will take up in their order. There are so many types of injectors that we will speak of the types that are most extensively used on locomotives, some of which are restarting—that is, if the water supply is shut off, either wholly or partly, they will allow the steam to pass out of the overflow opening instead of passing down back through the water supply pipe. This allows the vacuum to be maintained in the injector, so that water will flow up into it as soon as the water supply is restored. Other types of injectors will not do this. When they break, the steam supply must be shut off, the priming jet started alone, so the overflow opening can take care of all the steam and water till a current of feed water is started through the injector again, ready for the forcing jet to operate on.

Some injectors are called single-tube, of which the Ohio, Sellers and Monitor are examples. Others are double-tube. The Hancock and Metropolitan are examples of the last mentioned type.

All the above mentioned injectors have located somewhere between the steam tube and the boiler check an opening to the outside air, or overflow, through which the steam and water can pass out without much resistance when first starting the injector. In the old-style Sellers, or 1876 pattern, this opening comes between the delivery tube and the boiler. In the new Sellers, Ohio and the Monitor it is between the combining tube and the delivery. With the Hancock and Metropolitan there is a passage to the outside air between the lifting and forcing tubes.

There are two theories of the operation of an injector, one of which we will call the "velocity" theory and the other the "pressure" theory. We will take up the velocity theory first.

To begin at the foundation principle of the work of an injector, steam under pressure flowing from an opening has a very high velocity.

Water, when under the same pressure, with the same power back of it, moves at a much slower speed; the proportion is about 25 to 1. Now a machine that is so arranged that the stream of steam when it issues from the steam nozzle will impart its velocity to a stream of water from the suction pipe, so that the combined volume of steam and water will move through the combining tube at a higher velocity than a stream of water of the same temperature and density could be forced out of the boiler, will pass through the delivery tube with a velocity which gives a force sufficient to overcome the boiler pressure as well as have a considerable margin of power to take care of the friction of the piping and raise the check valve off its seat.

Mr. Kneass, in his book, "Practice and Theory of the Injector," gives a technical definition of an injector as "an apparatus in which a gaseous jet impinges on and is condensed by a fluid mass whose final kinetic energy exceeds that of a jet of similar form and density discharging under the initial pressure of the motive jet."

A practical explanation of this definiti n makes the "gaseous jet" steam from the boiler. As it must be condensed, compressed air will not do the work. The fluid mass is feed water entering the combining tube. Kinetic energy is the energy of motion; the energy of a bullet after leaving the gun barrel is kinetic energy. The jet of similar form is a stream of water which could be discharged from the boiler that the motive jet of steam comes from.

He also gives a more practical definition, as an "apparatus in which the momentum of a jet of steam is transferred to a more slowly moving body of water, producing a resultant velocity sufficient to overcome the pressure of the boiler."

On page 252 of LOCOMOTIVE ENGINEERING for May, 1898, the pressure theory is given as follows: "The steam flowing into the mouth of the steam tube is condensed by the water and the water heated somewhat. This mass of water practically forms a piston against which the steam acts; and as the area (and consequently the total pressure) here is greater than the area at the throat of the discharge tube, the water is forced into the boiler. The injector's action may be likened to that of a steam pump, the forcing of water being dependent on the excess of total pressure in the steam tube over that opposing the flow of water from the discharge tube. If the water is to be forced against a higher pressure than that of the steam jet, the area of the steam tube must be enlarged in proportion to the delivery tube, just the same as the steam cylinder of a pump must be larger in proportion to force against a high pressure than a low one."

The condensing of the steam when it strikes the feed water does have something to do with the operation of an injector. The steam strikes the water with the full force due to its velocity, and is then condensed into water, having only a small part of its former volume and becoming a part of the stream of water passing through the combining tube. If the steam is not all condensed by the mass of feed water, it will have so much volume that there will be no room for water, and the injector will "break"; or if it does not break altogether, the stream will not be *solid* water; it will be so elastic that it will come out of the overflow openings.

If there is an overflow opening between the combining tube and delivery, as is the case with the Sellers, Ohio, Monitor or Friedman injectors, when it comes out of the combining tube it will expand and strike the side of the delivery tube, instead of going straight on through the delivery, we say then that the injector does not "take up." Cut down the supply of steam or increase the supply of water, so all the steam is condensed, the combined stream will be a solid one, it will then all pass through the delivery, and the injector takes up. If the supply of steam is not powerful enough to give the solid stream the proper force, it will not throw a solid stream through the delivery tube and into the boiler.

If you wish to see the stream of water on its way from the combining tube to the delivery, take out the overflow valve of a Monitor injector or any other type that is so constructed that this opening between the tubes can be inspected through the overflow valve seat. After setting the injector at work look in; there you will see the stream of water passing from one tube to the other. Shut off the supply of water or steam till the injector does not pick up, and you will see the stream expanding after it leaves the combining tube, so that it strikes the outside edge of the delivery tubes. This object lesson will give you a definite idea of the operation of an injector of this type.

While we are talking about this matter of the steam all condensing, is a good time to explain why the ordinary injector won't work hot feed water. The feed water must lower the temperature of the steam jet down to the condensing point if the stream passing out of the combining tube is to be a solid one. Hot feed water will not take up or absorb as much heat as cold water, and may not lower the temperature of the steam jet sufficiently to leave a solid stream. High-pressure steam will not handle as hot feed water as steam of lower pressure, for the temperature rises with the pressure. There are about 55 degrees between the temperature of steam at 100 pounds pressure and at 200 pounds. That extra 55 degrees of heat must be taken up by the feed water. Warm feed water will not take up this extra heat as surely as cold. Haswell's Hand Book states that steam at 100 pounds will handle the feed water at 110 degrees temperature, while steam at 10 pounds will handle feed water at 148 degrees. Later tests show that this limit can be exceeded some for higher pressures. The tubes of an injector are arranged for working the maximum supply of feed water at a certain pressure of steam; when you get above that pressure of steam the capacity usually decreases. Thus you can have one injector whose greatest capacity may be at 140 pounds; by changing the tubes it will have the greatest capacity at 180 or at 200 pounds.

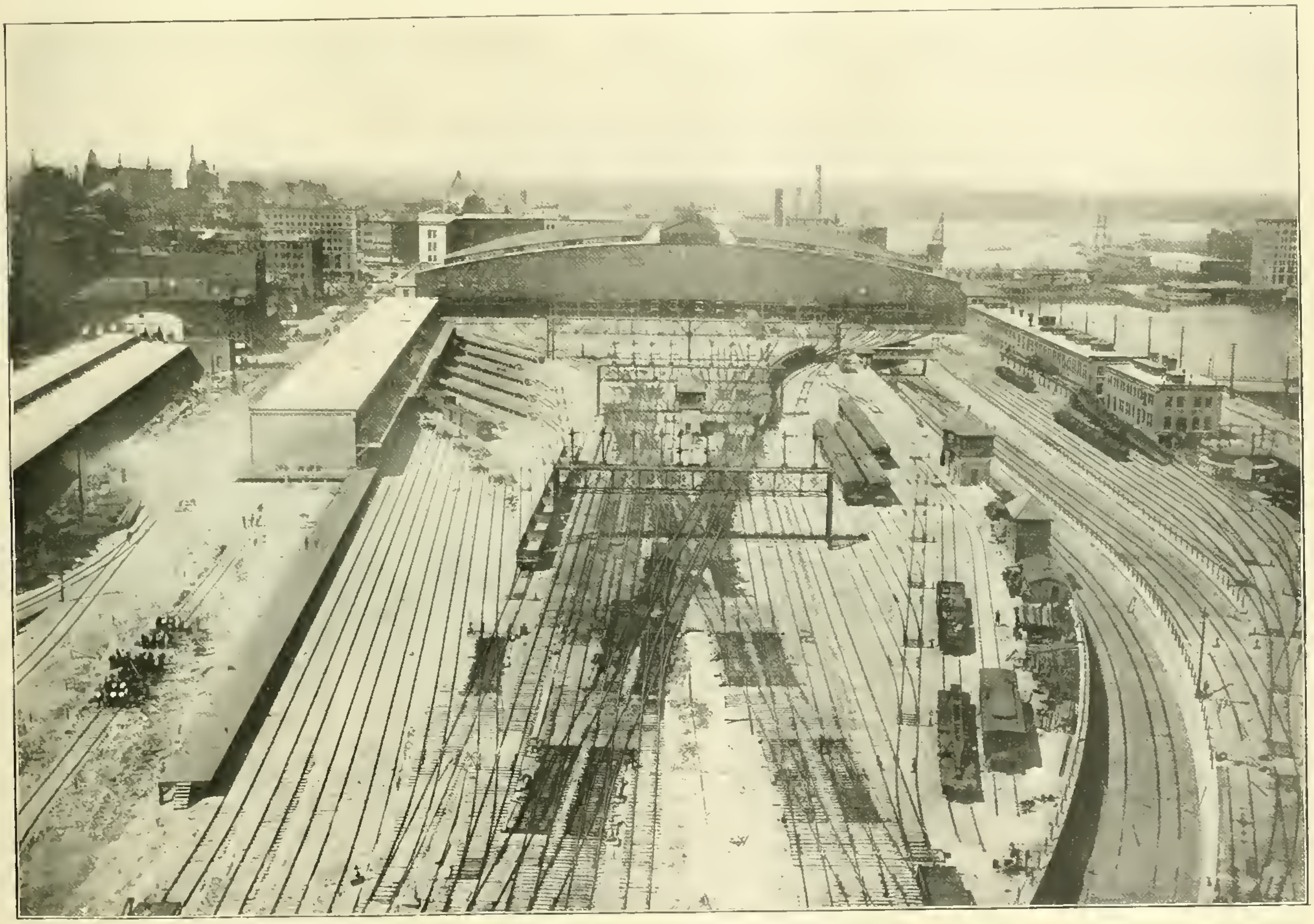
The pressure which an injector will work against is arranged for by the shape and proportionate inside diameter of the tubes. If they are built to work against a much higher pressure than that of the steam they will not handle very much water in proportion to the amount of steam used. If they are made to handle a large volume of water, they will not work against a high pressure, so injector makers take a mean between these two extremes and make the tubes of such a size and shape in proportion as will do the work in the most economical manner. Ordinary locomotive injectors have from 15 to 40 per cent. of "over pressure," as it is called, and this amount varies in the same injector with the steam pressure. It also varies as the tubes get cut out, or stopped up with scale.

Injectors made for the special purpose of testing boilers increase the pressure four times or more—that is, with 60 pounds of steam they deliver against 240 pounds.

The tubes of an injector should have a certain definite shape proportioned to the work they have to do. They should be smooth inside; if they are cut out by the action of the water or with a file or scrape, it interferes with perfect work. Scale stopping up the tubes changes the shape and area; it also stops up the area of overflow openings.

The spaces or openings in the combining tube or between the combining and delivery tubes are of service in starting the stream of water through the combining tube. Water and steam can pass out of these openings to the overflow till such time as the jet has force enough to pass on into the boiler. Restarting injectors have large openings to give a large area for the escape of steam and water. They must also have large overflow openings and waste pipes. Restarting injectors have open overflows, that close automatically when the injector is at work.

When the injector is working perfectly the stream of solid water across these openings forms a vacuum in the space which will draw in air or water, whichever can get in at the overflow valve. Injector makers take advantage of this action and increase the capacity of an injector by allowing some of the feed water to flow into this space. The jet carries it along into the boiler, thus increasing the amount delivered by the injector. The latest type of Sellers and Simplex Monitor have this by-pass for the feed water to reach the openings in the combining tube. You can try this easily by fastening the overflow valve open and immersing the waste pipe in a bucket of water. A No. 8 injector without the by-pass opening will take up at the overflow about all the



VIEW OF THE TRACKS LEADING INTO THE NEW SOUTH UNION STATION IN BOSTON.

water a ¾-inch hose will furnish, when working with a full supply of steam and water supply choked down a little.

The combining tube is very large where the water enters it. As the water receives the force of the steam its speed is increased, and consequently will pass through a smaller opening. At its opening it has to handle a large volume of steam. As the steam condenses it takes up less room also. This tube is contracted in about the same proportion that the volumes of water are contracted.

With the delivery tube the reverse is the case. It is coupled to a larger pipe. The diameter of the tube is increased as the speed of the jet of water is decreased. To get these tubes the correct size and proportion is the effort made by the technical experts who construct injectors. How well they succeed is shown by the reliable way an injector works when in good order.

Compressed air from a boiler or reservoir will not work an injector to force water into the same boiler or reservoir, because the stream of air after passing through the steam tube will expand at once, instead of condensing like steam. If the volume of air cannot all pass through the combining tube it will go back down the suction.

Air that is drawn in with the feed water breaks the solid stream in the combining tube.

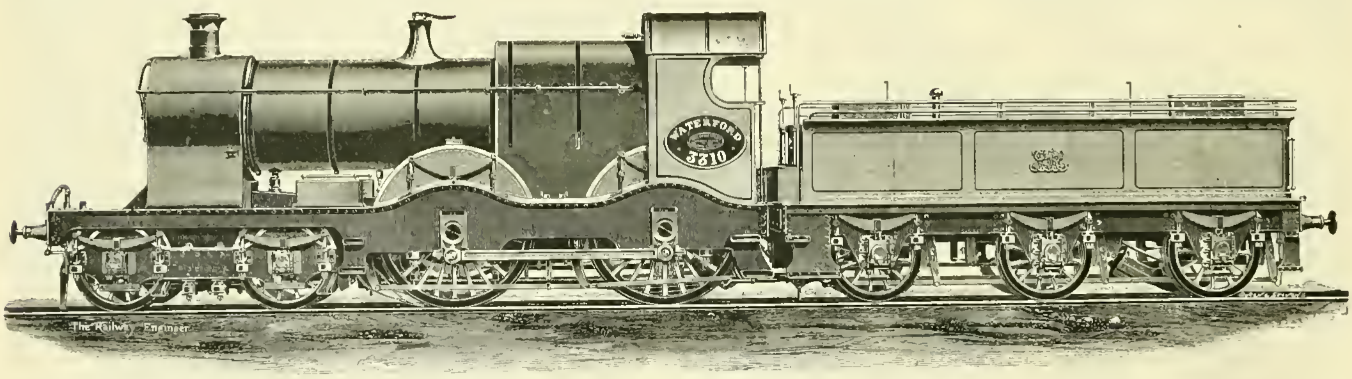
An injector should have supply and delivery pipes of ample size to handle all the steam and water to and from the injector. Supply pipes for water are usually of a generous size on the engine, but kinks in the hose and a very small area of opening through the goose-neck on the tender may spoil its work. Strainers in the hose are usually too small. The opening at all points from the water in the tender to the injector should be slightly larger than the water supply opening in the bottom of the injector.

If the steam valve on the boiler head which supplies a lifting injector is closed down till just enough steam passes through to pick up the supply of water, the engine will usually steam better. The steam supplied makes the force which works the injector. If you use any more steam than necessary to do this work, there is not as much left for the cylinders. Look out when the steam pressure drops; the injector is liable to waste at the overflow.

What raises the water from the tank up to a lifting injector? you ask. When the steam in its passage through the combining tube forms a vacuum, it takes the pressure off the top of the water in the supply pipe. This gives the atmospheric pressure in the tank a chance to force the water up to the injector and fill the vacuum. Cases have been found where the tank covers fitted so tight that no air could get in, and the injector would not lift the water.

Latest Type of English Locomotive.

The handsome express locomotive herewith shown, and which is copied from the *Railway Engineer*, of London, represents what might be considered the most advanced practice of locomotive engineering in Great Britain. The engine was built in the shops of the Great Eastern Railway of England, at Swindon, after the designs of Mr. William Dean, chief superintendent of the locomotive, carriage, wagon and signal department of the railway named.



EXPRESS PASSENGER ENGINE "WATERFORD," GREAT WESTERN RAILWAY.

The engine has cylinders 18 x 26 inches and two pairs of coupled driving wheels, 80½ inches diameter. The center of leading truck to the center of trailing wheels is 19 feet 9 inches. Height of center line of boiler above rails, 8 feet 6 inches. We understand that the engine represents in height and width the extreme limit of bridges and tunnels on the line, and may be regarded as the most powerful fast passenger engine that the company will ever get out, unless radical changes are effected on the permanent structures of the road.

The boiler has 1,520 square feet of heating surface. There is 23.65 square feet of grate area, and the boiler has a working pressure of 180 pounds per square inch. The engine weighs 117,000 pounds, of which 76,000 pounds rest upon the drivers. The ratio of adhesion to tractive force is about 5. Engines of this class are said to be giving very good satisfaction on express passenger train service.

Changing Tires.

A good many master mechanics do not take the driving wheels out from under the engine to turn the tires except in case of general overhauling, but keep sets of tires on hand already turned up. When an engine has tires in bad order, the old ones are taken off and the new set put on, with a delay of not over twelve hours out of service—quite an object when power is scarce. An engine can earn more in the time it takes to turn her tire on the wheel centers than it costs to turn and change her tires several times. Of course, all the wheel centers must be of a certain standard size to do this, so tires will be interchangeable from one engine of the same class to another.

This plan also keeps the tires in better order for service, for they can be changed on short notice and before they begin to damage the track or engine, instead of waiting till they are forced into the back shop.

An engine with tires all the same outside diameter, and no flat spots, will pull more tons than one with tires worn unevenly. Some one of the wheels will have to slip, which is a waste of power. This is a matter which affects the expense bills of the company, just the same as leaky packing or poor steaming engines. In one way the bad tires cost more—they damage the track and frogs seriously.

Tires are not usually worn alike on all wheels on the same engine. If trued up on their own wheel centers, they are all turned down to the size of the one with the flat spot; this wastes lots of good steel.

When they are taken off the wheel centers to true up, the thick and thin ones can be sorted out and matched up in sets. which can be fitted up ready for another engine. This saves something in tires and lathe work.

The master mechanic who has to overhaul the driving boxes as often as the tires get bad will not see much saving in this method; but if the tires are not allowed to run too long, the boxes will not need refitting so often.

Bad tires make bad boxes, and *vice versa*.

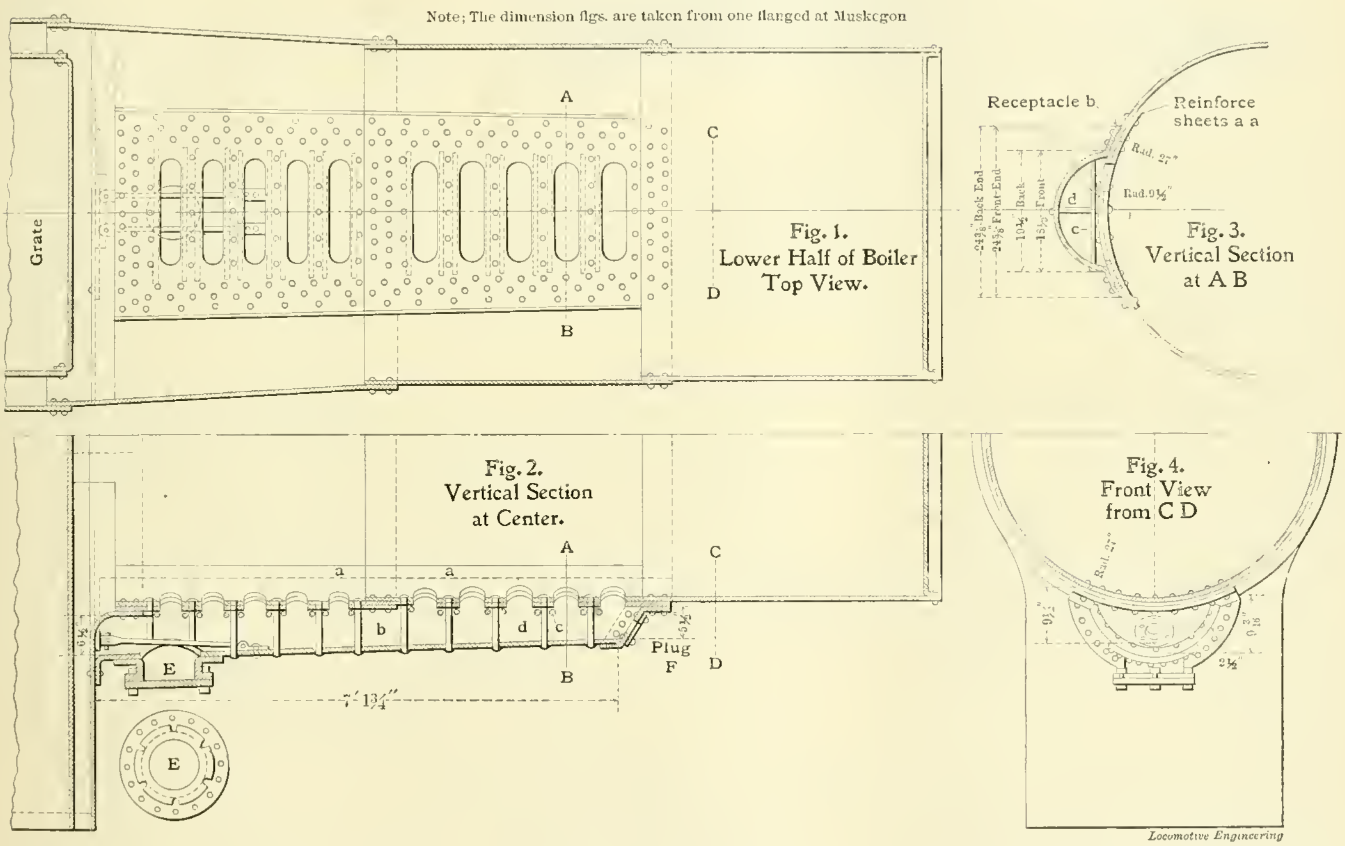
Haskell's Mud Drum.

There is nothing new in a mud drum attached to the belly of a locomotive boiler to catch the scale and mud which may work down from among the flues, but most of them are so small that they do not hold enough to be of much service, and only affect a very small surface of the flues, so that a blow-off cock is needed to blow out the deposit at regular intervals.

Mr. B. Haskell, superintendent of motive power of the Chicago & West Michigan Railway, applied the device herewith illustrated to engine No. 160 in May, 1898. This mud drum is semicircular in shape with a radius of 9¼ inches. It is attached to the belly of the boiler and the outside at the same time the drum is cleaned out.

The engine with this device from April, 1897, till shopped for repairs in 1898—less than eleven months—made 53,426 miles, and was stopped for flue work and found full of scale and mud. Since she began work in May, 1898, 72,029 miles were made to October 31, 1899. Nearly 10,000 miles have been made to January, 1900, and the boiler is reported good for 20,000 miles more, which will give the flues a service of two years. This service has been local and through freight of the heaviest kind. The water is hard at some stations and soft at others. About twelve months is the average life of the flues on this road. We understand the device is patented.

Steam Boiler with Mud and Scale Receptacle.



shell of firebox, extending forward 7 feet 1¾ inches.

It is located between the eccentrics and entirely out of the way of the straps. A reinforce sheet is riveted inside the shell of the boiler, and ten openings are cut through this sheet and the boiler shell to allow the mud and scale to work down into the drum, where it remains without hardening any more. One row of staybolts connects the bottom of the drum to the boiler shell. It is also braced with staybolts horizontally, as shown. The one in service has never leaked. To get at the flues next to the sheet with a washout nozzle, an opening is provided at *E* amply large enough. There is also a washout plug at *F*, through which a stream of water may be turned up between the flues

Old Ties for Fuel.

In a great many roundhouses old ties are used for lighting up the locomotives; if it were not such an expensive matter to prepare the ties for use, more of them would be used.

While many of the companies saw the ties to suitable lengths and split them, there are other methods more expeditious and economical.

The Chicago & Western Indiana Belt Line Railway have a machine, designed by A. J. Cunningham, general foreman, which splits the ties into four or five pieces, and afterwards, by a change in the blade, the pieces are broken up the right length. This machine is made of two 10-inch air-brake cylinders bolted end to end, with a piston packed both sides. This piston pushes out a triangular blade, which, when set horizontally, splits the tie, and when all are split a broad blade set perpendicularly breaks the pieces. Air pressure of 70 pounds operates this knife. There is a valve to admit air ahead of the piston, to cushion the machine when the knife goes through the tie. This valve is operated by the crosshead, the other air valve by the workman. The machine is simple. One man can split and break up a large pile of wood in a day.

The Chicago, Burlington & Quincy Railroad use a machine like a pile-driver, with a 500-pound weight raised by a 6-inch cylinder, with 4-foot 6-inch stroke. The weight is raised by air pressure and let drop on the piece of tie, which has been cut with a circular saw to the right length. This does not work quite as fast as one driven by air both ways. At the same place is a bulldozer built for the especial purpose of splitting and cutting off the ties at the same operation. This machine requires a gang of men, but it is intended to be moved from place to place as needed.

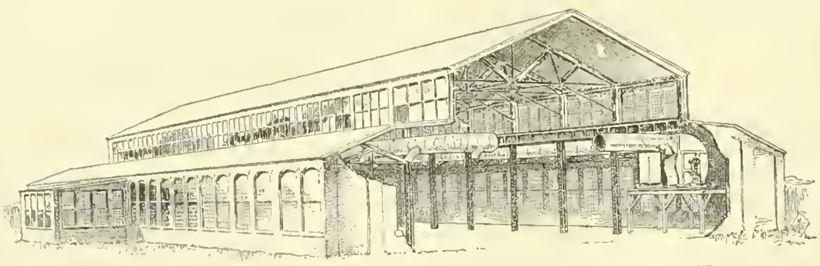
We could not get working drawings of these tools, but they cost very little to set up, and save a lot of hand labor in the preparation of kindling wood for locomotives.

We note that the number of railroad men who are becoming amateur photographers is on the increase. Send us some of the interesting views of railroading.

Heating a Locomotive Boiler Shop.

The character of the ordinary boiler shop is such that as a rule the simplest methods of heating may be utilized. It is highly desirable to avoid extended systems of heating surface, and to this end the blower system of combined heating and ventilation has proved a special convenience.

In the building herewith illustrated, which is one of a series originally erected for the Grant Locomotive Works, of Chicago, and now occupied by the Siemens & Halske Company, of America, this system was installed by the B. F. Sturtevant Company, of Boston, Mass., after its own designs. The apparatus is located upon a platform in one corner, and adjacent to the exhaust steam supply. Its elevation above the floor renders the space beneath available, and facilitates the return of water to the boilers when live steam is used.



BOILER SHOP OF THE OLD GRANT LOCOMOTIVE WORKS, CHICAGO.

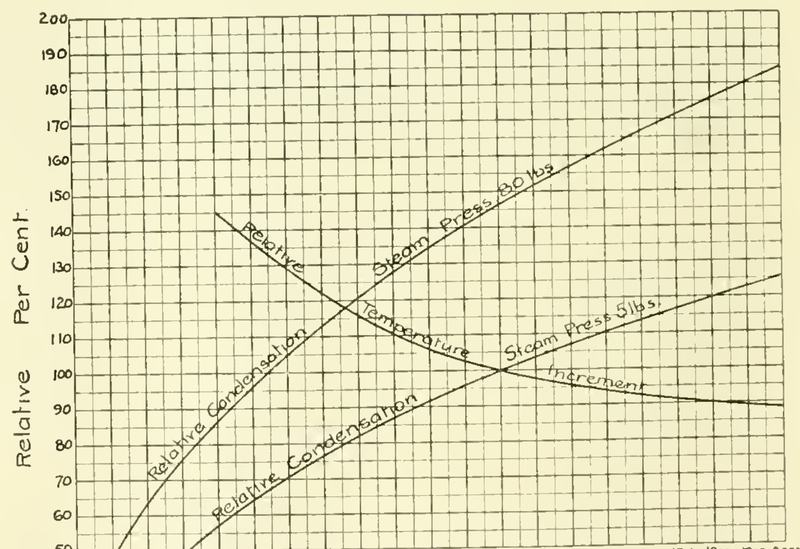
The apparatus is of the standard Sturtevant type, consisting of a steel pipe heater, a fan and a direct-connected engine. The heater comprises a series of cast-iron bases into which 1-inch steel pipes are screwed, and arranged for proper circulation of steam. Across these pipes the air is drawn, and by means of a fan is discharged into the overhead system of galvanized iron piping. The engine is of special type, bolted directly to the side of the fan, and having a common shaft therewith.

The air leaving the fan enters the piping system at a velocity of about 3,000 feet per minute, and under a pressure of nearly an ounce to the square inch. This compels circulation throughout the entire piping system, which is continuous round the building. The discharge therefrom is through outlets which point downward and toward the outer walls.

By this arrangement a warm barrier of air is constantly maintained between the outer atmosphere and the main body of the building. What is more, a slight excess of pressure is produced within the building, causing leakage to be outward and overcoming the tendency to inward drafts.

The massing of the entire heating surface in a single heater, and its enclosure in a fireproof casing, avoids all danger from freezing, leakage or fire. The high velocity of the air passing across the pipes, which approaches 1,500 to 2,000 feet per minute, renders the heating surface three to five times as efficient as it would be if exposed in the open air of the building.

The effect of velocity in increasing the relative condensation in the heater, as well as the effect of the steam pressure, is very clearly shown by the accompanying curves, plotted from results obtained in connection with Sturtevant heaters. It is natural that greater condensation should accompany a higher steam pressure. Furthermore, as the volume of air increases, resulting of course from increased velocity, the relative temperature increment, or increase in the temperature of the air, naturally diminishes, or as will be seen by the curve, it is 45 per cent. more with a velocity of 400 feet than it is with a velocity of 1,200 feet; but the total amount of heat transmitted to the air and fed to the building of course increases with the velocity of the air as well as with the temperature difference between steam and air, which is greatest with the high-pressure steam.



CURVES SHOWING EFFECT OF VELOCITY IN INCREASING RELATIVE CONDENSATION IN HEATER.

As a rule, the air supply in such a building is taken from the structure itself, and not from out of doors. Material economy in the steam required is thereby effected, while resulting leakage of air still maintains sufficient ventilation to meet all requirements, for the wide separation of the occupants of such a building, and the consequent large per capita space, do not call for an exceptional amount of air.

Lining of Shoes and Wedges.

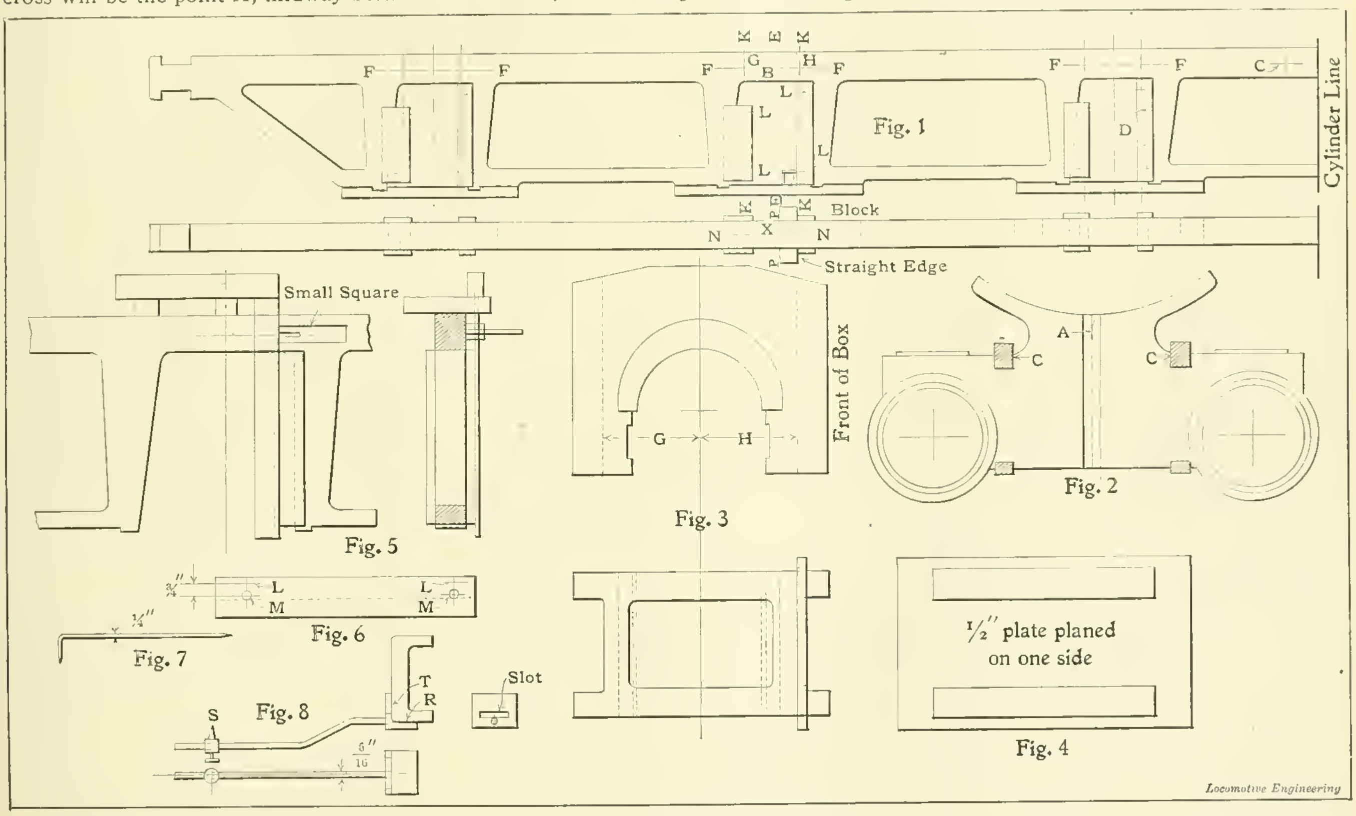
BY W. D. CHAMBERLIN.

The following method of lining up shoes and wedges is, I think, safe and practical if properly carried out. It has been used for years in one of our railroad repair shops, and gives satisfaction, having been much used on repair work where the old center lines and marks are worn off or cannot be depended upon, so that new and reliable lines have to be laid out.

In lining up shoes and wedges the utmost care should be observed when laying off distances or taking measurements, as the accuracy of the finished work depends, of course, upon the care which has been taken in doing it. This is true of most machine shop work, but particularly so with shoes and wedges, the work being simply a matter of taking and laying off certain measurements. The main object in view is to place the axis of the driving wheels and axles at right angles to the frames and parallel to each other, the distance from the axis of one pair of wheels to the axis of the next pair being the same as the length of the rod which connects them. There are other points which must be taken into consideration, but this is the principal one. In the first place, the frames, cylinders, boiler, etc., are supposed to be set up and firmly bolted into place. The pedestal braces should also be bolted into place. We will suppose the engine to have six drivers, the shoes and wedges being ready to set up, having been planed and fitted to the pedestal jaws, all planer work on them being finished except the face or surface, which bears against the driving box. This is left rough until properly laid out.

On the side of the frames over each jaw lay off short lines *F F*, Fig. 1, parallel to and equally distant from the top of frames. When this is done, a point *A*, Fig. 2, on back of cylinder saddle, equally distant from each frame and down a convenient distance from the boiler, must be located as follows: Lay off a point *C*, Fig. 1, on the inside of each frame near the cylinder, the distance from the finished surface *D* of the front jaw being the same on both frames, and the distance down from the top of frame also being the same on both frames. Mark this point lightly with a prick punch. Now get a piece of ¼-inch wire and bend it as shown in Fig. 7, the end bent being about 1 inch long. Cut the wire off long enough so that it will reach from the point *C* to where point *A* will come, then sharpen both ends. Place the point of straight end at *C* and with bent end scribe a line on cylinder saddle about where *A* will come, then do the same on the other frame. Where the two lines cross will be the point *A*, midway between at this point of intersection a point corresponding to *B* of the right side. Through this point scribe a line at right angles to the top of frame. This line is the center line of that jaw and corresponds to *E E* of right side.

In some cases the guide yoke or other parts interfere so that the movable point of the trams cannot be set at *B*. In such cases continue the center line *E E* across top of frame by means of a square set to *E E*, the blade extending across top of frame. On this line locate a point a certain distance from edge of frame, say midway between edges, and set the tram point to this point. Take the trams to the left side of the engine, place the point at *A* as before, and with movable point scribe a line on top of frame. Now lay off the line *N N*, shown on plan view of Fig. 1, have the center lines of the right and left main jaws. Now take an ordinary double pointed trams and carefully set them to the length of the side rods which connect the main drivers to the front drivers (it will be remembered that our engine has three pair of drivers, the middle pair being the main), place one point at *B* on the right main jaw of engine, and with the other point scribe a line on the side of frame over the right front jaw, intersecting *F F*. This point corresponds to *B* on the main jaw. Through this point scribe a line at right angles to the top of frame. This is the center line of that jaw. With the trams set at same distance, go on the other side of engine and repeat the operation for the left front jaw. Now set the trams to the length of the side rods which connect the main drivers to the third pair



LINING OF SHOES AND WEDGES.

the frames. Before locating *A* it is best to chip off the rough casting at that point and make a smooth surface to work on. Mark the point *A* with a prick punch. Now go to the right main jaw and lay off its center line *E E*, intersecting *F F* at *B*, Fig. 1.

It is best to use the main jaws to work from, but if they are unhandy to get at, use the front jaws. Take a long "fish" tram with one movable point; place the pointed end at the point *A* on cylinder saddle and set the movable point at *B* on the frame (right main jaw), the intersection of *E E* and *F F*. Take the trams to the left side of the engine, leaving it set at this distance, place the pointed end at *A* as before, and with the movable point scribe a line on side of frame over left main jaw, intersecting *F F*, thus locating midway between edges of frame and intersecting the line scribed with trams at *X*. Scribe the line *P P* through *X*, across the top of frame, and continue it down the outside by means of a square. This latter line then is the center line of that jaw (the left main), and corresponds to *E E* of the right side. Of the two methods just described for locating this center line, the first is the best and safest, and should be used whenever possible.

The "fish" trams mentioned may perhaps be strange to some machinists. It consists of a long rod (⅜-inch iron pipe is suitable) about 12 feet long, one end being drawn out to a rather blunt point. One ordinary tram point is used, it being provided with the usual set screw so as to set it at any position on the rod.

To continue with our work: We now of drivers, and repeat the same operation for the third pair of jaws. We now have the center lines *E E* of all the jaws. The utmost care and caution should be taken in this work, as a large pair of trams can very easily play tricks on the man who handles it. The work should be gone over with again in order to prove its accuracy.

The next thing to do is to consider each driving box, which should by this time be ready to set up, the machine work on them being finished. The boxes are supposed to be bored out central; *i. e.*, $G = H$, Fig. 3. They are, however, not always bored central, owing to faults of workmanship and other causes, so it is best to take this into consideration.

Take a box, say the right main one, get the distance *H* from the center of the brass to the front bearing surface, and lay it off on $F F$ of the right main-jaw, measuring to the front from the center line $E E$, thus locating point H^1. Do the same with G, measuring back from $E E$ and locating G^1 on $F F$. Take each box and repeat the operation for its corresponding jaw. These points H and G show the exact position which the box should occupy in its jaw. By doing this the center line of the box will be kept at the center line $E E$ of its jaw, no matter if the box is not bored out central. To get G and H take a piece of lead or a piece of wood with a tin strip set in its surface and place it between the sides of brass bearing, then take maphrodite calipers and locate the center of the brass bearing on this lead or wood piece. A ½-inch plate planed on one side and cut out to the shape shown at Fig. 4 should now be made. This can then be set on the bearing surface of the box, the plate projecting over the side of the box as shown in the plan view of Fig. 3. The distance H or G can then be obtained by measuring from this plate to the center of the brass previously located on the strip of lead. The plate should be made so that it can be used on any ordinary box. It can then be used on any job of shoes and wedges.

To return to the frame: We have now located on each jaw the position which its box will occupy. Now take each shoe and set it up in its place on the jaw, the set bolt being set up tight, thus holding the shoe firmly in position. The line $K K$, passing through H and parallel with $E E$, must now be scribed on the outside of the shoe. In order to do this, place two parallel strips across the top of frame, the ends projecting over the edge of the frame. Take a large square and set it on these projecting ends, with the blade hanging down at the side of the shoe; then take a small square, place it on the side of frame with blade at H, and move the large square until its blade touches the blade of small square. While doing this hold the small square firmly in place and keep the blade of large square pressed against the side of shoe, but be careful and not cramp it so that it will not rest evenly on the parallel strips. When the large square is properly located, take your scriber and scribe a line along its edge upon the side of shoe, thus locating line $K K$. In order to prevent the parallel strips from tipping off the frame on account of the weight of the square, place a piece of iron of sufficient weight upon them as they rest on the frame. Fig. 5 shows the arrangement of the squares and shoe. This operation should be repeated on all the shoes.

The next thing to do is to locate on the inside of the shoe a line corresponding to $K K$ and at the same distance from $E E$. Take a long straight-edge and pass it between the jaws and across the engine from frame to frame. Select two points $L L$ on $K K$, near the top and bottom of the shoe. Cut two small wooden blocks long enough so that when placed on the pedestal brace (one on each brace), with the straight-edge resting on them, it will come opposite the lower point L. Two blocks should also be cut so as to reach the upper point L in the same manner. With the straight-edge resting on these smaller blocks, place it so that it is the same distance from L on each shoe. The plan of Fig. 1 shows one block and the end of the straight-edge as it rests against the shoe.

Now take your maphrodites and set them to this distance; *i. e.*, from the straight-edge to L, which is equal on both sides of engine, then lay that distance off on the inside of the shoe with the leg of the maphrodites placed against the straight-edge. Do this on the other shoe on the other side of the engine, then place the straight-edge on the long blocks in the same manner and repeat the operation for the upper point L. Scribe a line through these two points just located on the inside of shoes. This line then corresponds to $K K$ on the outside of shoe. Repeat this operation on all the shoes.

If the distance H is not the same on the opposite jaws it will be seen that the above operation is not theoretically correct, but unless the distance H varies greatly it is considered close enough for practice, the error being very small.

After all the shoes are thus laid out, they are taken down and planed to these lines. Before taking them to the planer locate with your dividers a point M, Fig. 6, a certain distance from L on the side of shoe—¾ inch is a convenient distance. It should be laid off from each point L, and a small circle described about it so as to make its position plain. After the shoe is planed, by measuring the distance from the planed surface to this point, it can be seen whether the shoe was planed to the lines laid out. This is called a "proof" mark, because it is a means of proving whether the shoe was planed as laid out. If this mark is left off the planer hand can swear that he planed to the lines, and his word will have to be taken.

After the shoes are all planed, set them up in place again; also set the wedges in place on their respective jaws, the wedges being set at their lowest position. Now take a large pair of calipers and caliper the distance between the bearing surfaces of the right main driving box, *i. e.*, $H + G$, Fig. 3. A line $K K$ parallel to the planed surface of the shoe must now be scribed on the wedge, both inside and outside. The handiest and most accurate way to do this is by means of the tool shown at Fig. 8. This consists of a piece R, shaped as shown, the inside surfaces T and R being at right angles to each other. In this piece is screwed a 5-16-inch steel rod, with an offset and a movable point S. The side T has a slot cut in it for convenience in setting the point S to its proper position. Set the point S a distance from the surface T equal to the distance obtained by calipering the box.

Place the squared surfaces R and T against the corner of shoe, the surface T bearing against the bearing surface of the shoe, and the surface R bearing against the outside of shoe as shown. Now slide the tool down the shoe, holding it firmly with the point S against the side of the wedge. This scribes a line $K K$ on the side of the wedge parallel to the planed surface of the shoe and at a distance from it equal to the distance between the bearing surface of the box. Do this on all the wedges both inside and outside, being careful to set the point S for each box, then take the wedges down, put on the proof marks and get them planed.

After the wedges are planed set them up in place again, then place the long straight-edge across from frame to frame as before, first rubbing its edge with damp lampblack. Place this edge against opposite shoes or wedges and rub it back and forth a few times, then notice how it bears on the surfaces. By this means it can be seen whether the bearing surfaces of opposite shoes or wedges are parallel to each other or not. To test the work in another way, caliper the boxes again and set the inside calipers and caliper the corresponding shoes and wedges. As a final test after the wheels are placed under the engine and wedges set up in place, the side rods not being up, go to each wheel and plug up the center holes made at the lathe, by hammering lead into them, then with dividers carefully locate the center of wheel, a circle for this purpose being usually cut in the hub of wheel when it is in the lathe; then lightly prick the center. Do this on all the wheels. Now set the large trams to the length of the side rod as before, place one point in center of main driving wheel, and try the center of the next pair of drivers with the other point.

It can then be seen whether the work is right or wrong. Try all the wheels this way with the trams set to the proper length. If the work has been carefully done, the wheels will undoubtedly come all right.

It will be noticed that the point G, Fig. 1, was not used in locating $K K$ on the wedge. It is not necessary to lay in G, but it will do no harm to do so, as the position of $K K$ on the wedge may be compared to it as a proof.

This method of lining up shoes and wedges, of course, cannot be used in all its details on some makes of locomotives, owing to their peculiar construction, but it will be found that it can be used on ordinary engines. For instance, in getting the line $K K$ on the shoes by means of the squares and parallel strips, as described, it will be found that this cannot be done on the rear pair of jaws with those locomotives where the firebox sets on top of the frame. Instead of getting $K K$ in the manner described, it may be located by setting the large trams to the length of side rods, as before, and tramming from $K K$ of the main shoe, then $K K$ of the wedge can be obtained as usual.

General Correspondence.

All letters in this department must have name of author attached.

"Why the Locomotive Goes."

I was glad to see the question of the fulcrum of a locomotive wheel appear in your esteemed paper, for not only do such articles get a fair hearing, but all readers of Locomotive Engineering criticise so as to gain knowledge.

This same question in an English mechanical paper would create a civil war in a few years if the editor chose to keep publishing all he received on this head; indeed, in a few years time no paper yet published would be large enough to contain the articles sent in by the opposing parties, for there are as many in favor of the fulcrum being considered at center of axle, similar to a stationary engine, as there are that the point of contact between wheel and rail is the same.

Mr. J. B. Rich in your paper of October states that the trouble comes in from considering the power applied at *A* as being from an outside force, referring to a stick. My own opinion is that it is just such explanations as this that cause confusion of thought, and it would be much better to give the P., F. and W. when referring to a lever showing where the power was applied, the fulcrum of the lever and the work done, not forgetting the all-important fact that the definition of the word fulcrum is "the fixed point of a lever," *i. e.,* fixed in relation to the work done, for it is possible to have a moving fulcrum as well as one fixed when doing work similar to Fig. 2. The explanation does not explain why the wheel rotates in direction of arrow.

As my views regarding the fulcrum do not agree with either the center of axle or rail argument, I will give the same.

To begin, I will take a stationary engine. When the crank is on top the wheel is pulled around, and when on bottom it is *pushed* around. I venture to say that there is no discussion as to P., F. and W. of the lever as shown in Fig. 3; the power at all times being applied at the crank pin, the fulcrum being constant at center of axle. When we come to place the wheel on the rail, conditions alter entirely, for the wheel can only be made to rotate by a succession of *pulls* at a part of the wheel, while it is held at another part. A push at no part can make it *rotate forward,* no matter whether you are standing on the ground, as shown by Fig. 1, or sitting on the machine, as shown by Fig. 2. It is not the push on *B* that shoves the wheel around, but the pull that is conveyed to the axle that pulls it forward. It will therefore be noted that the fulcrum of the wheel is at the crank pin when the crank is on the bottom, and that the lever is one of the first order. In plain words, the cylinder moves over the piston when the crank is below, the former pulling the axle forward, whereas on the top (see Fig. 4) the piston is pulling at the crank pin, the P., F. and W. being as shown in each case.

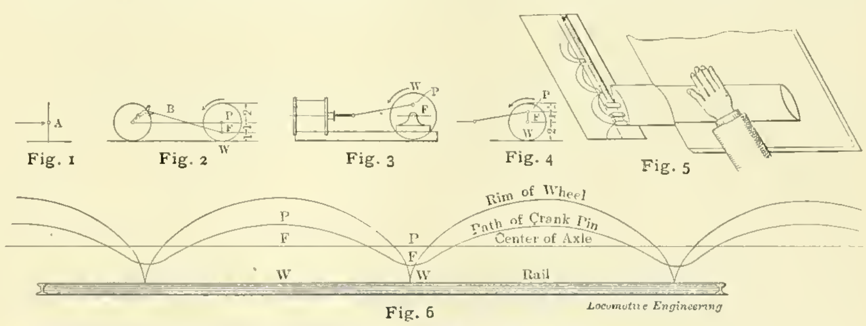
With this explanation those interested will now readily understand why with this change of fulcrum the locomotive is so heavy in wear and tear of machinery, and why it cannot be compounded successfully in all countries as is done with all stationary engines.

It will not escape notice that I have assumed the levers to be both of the first order when the crank is on top as well as bottom, the former being 2 to 1 and the latter 1 to 1.

It may be due to this latent fact that the mechanical world has for so many years failed to teach the students one common view as to why it is a wheel rotates when the crank is below. It must seem surpassing strange to not a few that in this our nineteenth century practical men cannot agree on such a simple problem.

It will also be noted that I have shown the W. as at point of contact of wheel and rail. We all know that without adhesion we could not get work from a locomotive, moreover it is possible to do a dual duty by propelling the rails backward, and rolling the wheels forward on the rails at the same time, so that this being the case the W. must be the rim of the wheel and the fulcrum must be between the P. and W.

To explain away the mystery as to why the levers do the same work, let anyone turn up a piece of wood to scale (see Fig. 5) and put pencils in the center of axle and crank pin and so find the path described by the levers through space, which is as shown in Fig. 6, and which explains how the work done by each lever is equal.



WHY THE LOCOMOTIVE GOES.

The writer has for many years looked upon the locomotive as the most imperfect machine ever designed, and the day is not far distant when all locomotives will be made quite as successful a machine when compounded as any non-condensing stationary engine.

Your editorial remarks of a year ago "as to why it was that all engineering shops were not working night and day converting simple engines to compound" may then become an accomplished fact.

John Rickie,
Loco. Insp., East Coast Ry., India.

American Locomotives in England 50 Years Ago.

There was an article in your November number, copied from the Toronto *Globe,* in reference to American locomotives shipped to England in the year 1840. A copy of an article by Clement E. Stretton, C. E., on "Locomotive Engine and its Development," published in 1893, reads as follows:

"The first part of the Birmingham & Gloucester Railway was opened June 24, 1840. This line was intended to form a portion of a great through route between the north and west of England. It was, therefore, a very serious mistake on the part of an engineer, Captain Moorsom, to have designed and constructed the great Lickey incline, of 1 in 37 for a distance of over two miles, extending from Broomsgrove to Blackwell, and it was an equal mistake to suppose that English locomotive builders could construct an engine to ascend the incline. However, they could not do it, and he ordered eight locomotives from Norris & Co., of Philadelphia, the first four to arrive being named England, Philadelphia, Columbia and Atlantic. These engines had a four-wheeled bogie, a single pair of driving wheels placed in front of the firebox, and outside inclined cylinders. Diameter, 10½ inches; stroke, 18 inches; driving wheels, 4 feet; weight in working order, 9 tons 11¼ cwt. Their usual performance up the 'Lickey' was 33 tons at 12 to 15 miles per hour, 39½ tons at 10½ miles, or a maximum load of 53¼ tons at 8½ miles.

"One of these American engines, having 11½-inch cylinders, was lent for a few weeks for trial upon the Grand Junction Railway, when it was ascertained that it conveyed loads of 100 to 120 tons on an incline of 1 in 330 at 14 to 22½ miles per hour; or on an incline of 1 in 177 at 10 to 14 miles per hour. The mean of seven journeys from Birmingham to Liverpool, with gross loads of about 100 tons, showed a consumption of 50 pounds of coke per mile, of evaporation of 4.27 pounds of water per pound of coke.

"The American engines having worked with great success upon the Lickey incline for a few weeks, Mr. Edward Bury, of Wolverton, wrote to the directors to declare that whatever American engines could do his could do, and sent the London & Birmingham Company's engine named Bury to prove his assertion.

"Mr. Bury, himself driving, started from Broomsgrove, and humorously called to Mr. Gwynn, who had come with the American engines, to join him. 'No,' he replied; 'it's no use; you'll soon come back again.' And back again Mr. Bury and his engine came, having stuck before getting half way up the incline.

"In consequence of this, taunts which appeared in an American newspaper were made to the effect that the English could make inclines, but had to come to America for engines to work them."

Hoboken, N. J. W. H. Lewis.

Premium Plan.

Mr. R. T. Shea attempts to show where piece work is superior to premium plan, and, from my point of view, utterly fails to do anything of the kind. It must be obvious that the proportion of the saving which the man and the company get can be adjusted to suit any case. Some places use one-half, others one-third, etc.

In citing the case of turning tires, Mr. Shea entirely overlooks the fact that while the man makes *less per piece* as he works faster, he also makes *more per hour* or per day. If he only expected to turn one pair of tires, and there was no more work in sight, he would not be a common mortal if he did it in half the time allowed, unless he wanted to go to a ball game in the afternoon.

How he figures a loss to the man who has increased his hourly earnings and his daily earnings is beyond my comprehension. The claim that the company makes more than the men is probably true. Isn't it true in any case? But if I am making more than I was before, why should I kick if someone else does also?

Piece work is all right if both employers and workmen tried to be perfectly fair with each other, and thoroughly understood each other's position. Unfortunately this is not the case, and the average mechanic looks on piece work as a plan of the devil himself, and not altogether without cause.

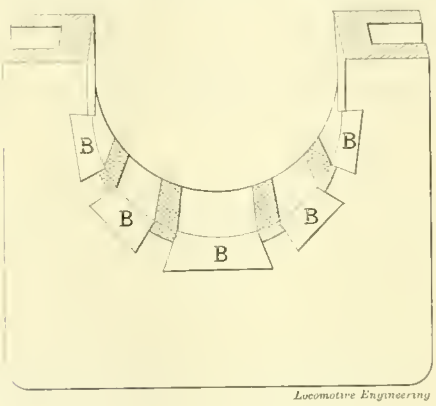
To my mind, the beauty of the premium plan is that it shows the employer his gain so unmistakably that there is not the temptation to cut rates as in plain piece work. Mr. Shea is not alone in having practical experience in piece work, and he should consider himself fortunate in securing such pleasant relations that piece work caused no friction. My own includes strikes, lockouts and heavy loss to both sides owing to the inevitable "cut" in rates. I. B. Rich.

Honeybrook, Pa.

About Driving Boxes.

On page 35 of January issue you show an "Eddy" driving box that was never made by Mr. Eddy. It was probably put under an Eddy engine by Mr. Underhill, but it is a Mason box, and not a very good job either.

The Eddy driving box was made like the sketch I send with this. He planed out



WILSON EDDY'S DRIVING BOX.

five dovetails and forced in brass strips, as *B, B, B, B, B*. Between these he ran babbitt strips as shown by the cross-hatched portions, the babbitt being held by holes in the iron strips into which it runs. This made a box that gave excellent service.

Later Mr. Twombly, of the Rock Island road, adopted a decidedly cheaper plan. He cast his brasses solid and ground the outside on an emery wheel to clean them up. Then he put these in the mold and cast the iron around them. The iron shrinking held them very firmly. If they worked loose in service, he drove them out, put a liner between the top of the box and the brass and forced them in again. It was cheap and did the work in good shape. R. E. Marks.

Camden, N. J.

Some men are known by the number of times their names appear on the work book; others by their absence from it. It isn't always the man's fault either.

Engineers' Ailments.

While this is no mechanical discussion, still it is one that concerns enginemen; for our health is an important factor in qualifying us for our positions, and makes us capable of giving good service mentally and physically. As the inventive genius of railway improvements is constantly shifting the responsibility of the movements of trains upon the engineman, it behooves us to keep our bodies well, thereby insuring a clear mind.

Engineers often complain of a soreness, or a common misnomer for the feeling is rheumatism, in their left arm, and wonder why that member should be afflicted instead of the right one, this arm being constantly exposed to the elements on account of being in the open cab window. The cause for this trouble is not from exposure, but from grasping the throttle lever too firmly and holding the arm in an unnatural position for too long a time. If he will occasionally allow his arm to drop to his side for a short while, to rest it, or if he will frequently change the position of this arm, to sound the whistle, try the water or any movement to relax the muscles, he will find relief, and the soreness will soon leave entirely. This feeling is not experienced on local runs or where the duration between stops is short, but on through runs, where the arm is sometimes maintained in one position for a considerable length of time.

Another of the greatest causes that give enginemen ill feeling is stomach trouble that has been brought about not so much by eating cold victuals and at irregular hours as it is the time when eaten, or rather the condition that the body is in when they do eat. The stomach trouble of engineers often originates while they are employed as firemen. You have all seen—and probably have done so yourselves—a fireman standing before the strong heat from the furnace door, exhausting his vitality in the attempt to maintain steam pressure on the boiler while the engine is working hard on a heavy grade. This he continues until the summit is reached; then, while the train is drifting down the opposite side of the hill, and the fireman has a little leisure time, he secures his lunch bucket, and without thought of his impoverished, heated or nervous condition, he begins loading his stomach. The result is, instead of the food being digested and giving nutrition, it is fermented, and will prove more injurious to the body than benficial. While it may cause no particularly ill results at first, if continued it will gradually cause a diseased stomach.

If enginemen would always try to do their eating while their bodies are in a normal condition, and when their work will not be too laborious or severe for a short time after eating, to allow the secretions in the stomach an opportunity to begin the process of dissolution of the food, they will remove the cause that produces much stomach trouble.

Another cause for complaint is a soreness in the small of the back, which they call "kidney troubles." This is caused by engineers assuming the position of the modern scorcher on a bicycle, with the short ribs resting on the sill of the cab window, receiving the brunt of the shocks and jerks of the cab, more particularly if the cab is loose or the engine is badly counterbalanced. These shocks produce a soreness where these ribs are attached to the spinal column. If this stooping position is maintained too long, it produces a soreness of the muscles of the back, the left ones being extended and the right ones greatly contracted. This feeling is more noticeable if the engineer is making a fast run or a meeting point on close time, when the nervous system is aroused.

If all enginemen would try to assume natural positions in their work, eat when their bodies were in a normal condition, eat food that is nutritious, dispense with pickles, soggy pies and sweet milk when the body is heated, I believe they would find a marked improvement in their health.

W. J. Torrance.

Evansville, Ind.

Those English Locomotives.

I have heard from a friend in England who is interested about the American engines, and who says they are doing good work. They start quick, handle a train well, and the men like them; but they use considerably more coal than the English engines hauling the same trains.

He's an Englishman and a firm believer in short valve travel, as their engines have, and he is willing to wager his last year's overalls—they're not Peters', though—that if they will just cut down the valve travel from 5 inches to about 3½, like their engines, they'll do splendid work.

Will somebody who has had experience with short valve travel tell us what they think of it?

Frank Gleason.

Richmond Hill, N. Y.

Valve Motion.

I was much interested in the article on "Valve Motion," by Mr. Rolfe, but there is one point I don't agree with. He says: "But these valves (eccentric-driven) have the objection of opening slowly both to steam and exhaust. Now, what is wanted is quick admission—that is, the piston should receive a large volume of steam as quickly as possible, and receive it, too, when the engine is in position to make the best use of it, which is *not* when the crank is on the center."

The desirable features he mentions I agree with—but is the present link motion deficient in these points?

According to my understanding, the valve does open quickly as the piston is moving very slowly at the end of the stroke. Following a valve model, we find that when the piston has moved a very short distance the valve is wide open. The eccentrics being at right angles to the crank (less the angular advance due to lap and lead of valve) give the valve its fastest motion (nearly) at the time of the slowest movement of piston. When it comes to cut-off, the piston is moving faster and the valve slower, so that his criticism has more weight. If we could have a late admission of steam, say when the piston was quarter way on its travel, and cut it off at half stroke—*without filling the first quarter with steam that was doing no good except warming up the cylinder*—it would seem as though we should get better results; but as this is impossible in ordinary practice, we must do the next best thing. What this is may be open to discussion. If we give large lead we admit considerable steam before the end of stroke, exert a retarding influence, and only do good by heating up the cylinder.

Suppose we have no lead (and with the engine on the center a wide-open port don't help start it—the other side does the work), then as the piston starts slowly the valve begins to open, and as it opens faster than piston moves, it maintains pressure behind piston which is now getting into its most effective position. The same heating of cylinder, as well as easing an engine over the centers, can be obtained by compression, and there need be no difficulty on that score with the link motion.

This is an almost endless subject, but I'll stop here for this time.

F. C. Henry.

Port Jervis, N. Y.

A Combined Shop Engine and Air Compressor from an Old Locomotive.

Thinking perhaps some of our old friends would be pleased to hear that we are not dead down in this small town, where the main shops of the L. H. & St. L. are located, and being a constant reader of your good journal, will endeavor to tell you what we have been doing the past year.

The most important was the changing of one of our old locomotives into a stationary engine and air compressor combined. The right side we use to run the shop, being 17-inch cylinder, and we have provided for cut-off by leaving the link.

The left cylinder was bushed to 9½ inches with water jacket to keep it cool. We removed the firebox and frame just back of main drivers; turned the flanges off tires so we could use the drivers for pulleys. The shell of boiler we use for air reservoir. So you can see, by blocking our engine up on foundation, we have a cheap shop engine and air compressor. Our master mechanic, Mr. P. D. Plank, purchased an air drill and hammer, and we are making good use of them. We have the air piped to all the shops, and make good use of it with our gasoline paint remover on the coaches. Mr. McCracke, our painter, says he can't get along without it.

Our car man, Mr. Berry, makes good use of the air, trying the brakes on the cars. I hope you will see fit to keep part of the letter out of your waste basket.

Harry S. Hills,
Foreman.

Cloverport, Ky.

Early High Speed in England and America.

I am very much interested in your paper, and I take it in because I think it better than any paper, English or American, now published on engineering subjects. Being an apprentice in the Great Western Railway factory at Swindon, I am naturally very much interested in matters concerning the company I am connected with.

I notice in your November issue, on page 479, under the heading "Remarkably Fast Run Made Forty-six Years Ago," that you say the "speed attained by the locomotive on the run from Laporte to Chicago and back was fully up to, if not superior to, the speed attained daily by the English Great Western between Paddington and London.

Now, Paddington is the London terminus of the Great Western Railway. I suppose it was a misprint, and would you kindly state what the other place is, and so oblige?

I can't find what your American standard (rail) gage is. Would you mind telling me?

Philip H. Smith.

Sandringham Villa, Swindon, England.

[The article referred to ought to have read between Paddington Station, London, and Swindon. Our standard track gage is 4 feet 8½ inches, but a considerable percentage of our railroad track is 4 feet 9 inches. We also have a variety of narrow gage lines.—Ed.]

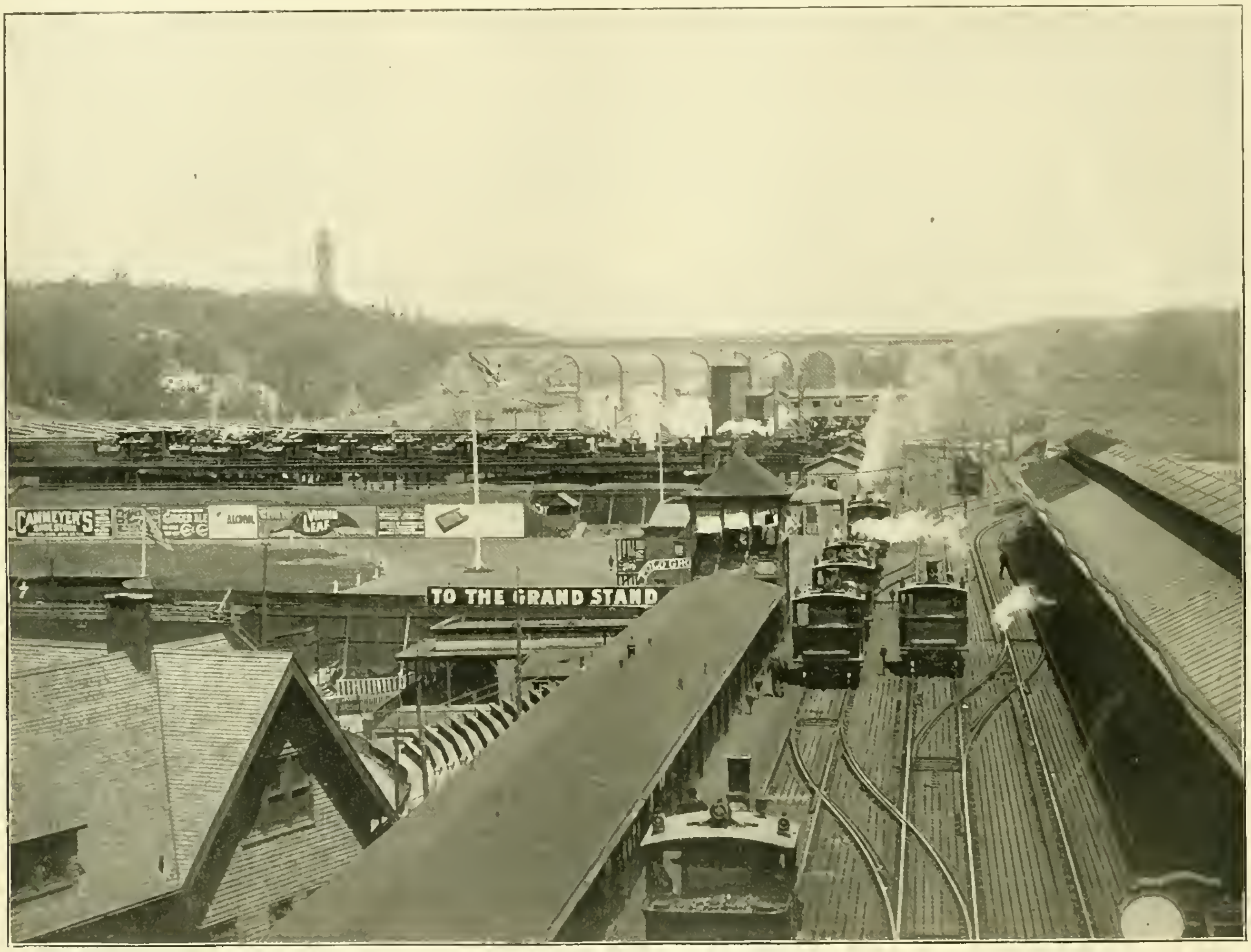
We have never known of any great invention that the credit of suggesting it was not claimed by someone who had none of the attributes necessary to put into practical shape any invention. For hundreds of years philosophers talked and wrote about the immense possibilities of heat doing work through the medium of steam, but they did practically nothing. If any credit is due to the philosophers in regard to the invention of the steam engine, it was that they kept the world familiar with the fact that water converted into steam and confined in a closed vessel had wonderful power. It took practical mechanics who knew little about science to devise the harness that put the force of compressed steam under perfect control. To those men is due the great credit of giving to the world the steam engine.

Mistakes in Designing Valve Motion.

SECOND PAPER.

BY H. ROLFE.

In the earliest stationary engines, so we have read, valves that had no lap were used, and down to the year 1838 locomotives had as little lap as 1-16 inch. Soon, however, it was seen to be desirable to get more expansion and to vary the rate of it according to the work required of the engine. By the time another five years had elapsed, valves were running with a 1-inch lap and a link motion practically as we now know it. The economy resulting from the increase of lap was very pronounced. It will be granted that up to a certain point it is a good thing to expand the steam fully, to get as much work out of it as possible; it is obviously a smaller loss to start exhausting when the steam is at, say, a pressure of 20 pounds than when at 100. The consequence was that the thing was carried too far. The writer remembers it being looked on as "gospel" to run with throttle wide open and lever notched right up. This at least was the answer expected from engineers and firemen under examination, when asked how to work an engine with the greatest economy. There must have been many men, however, who knew better, but they gave the answer expected, which showed considerable wisdom on their part. They could not have helped finding out that they could have run farther on a tank of water when cutting off later; more water used means more steam, and as steam has to be generated from water at the expense of fuel, the above practice (wide throttle and very short cut-off) represents an increase in fuel consumption. The reason is that in early cut-offs the range of temperature is very great, resulting in a correspondingly large initial condensation. Thus, the earlier the cut-off the lower will be the final temperature of the steam. Thereby the temperature of the cylinder walls is lowered, and when steam is next admitted it will condense considerably until the walls regain their temperature. Of course, at high speeds (which accompany short cut-offs) there are modifying influences at work; thus, the earlier the cut-off, the earlier the exhaust is closed, and therefore the greater is the compression. Compressing the steam raises its temperature, and therefore keeps up the temperature of the cylinder somewhat; so that, as the steam at the next stroke does not meet such cool surfaces, there is less condensation. Also, it requires time for a cylinder wall to give up its heat, and at high speeds there is less time for this lowering of temperature to take place. We have pointed out these mitigating influences, but the fact remains that it is not conducive to economy to cut off too early, and the practice is now being discountenanced—from 25 to 30 per cent. being the average minimum cut-off for fast passenger work. Not only will considerations of economy lead an engineer not to hook up so much, but also a regard for his crank-pins; for early cut-off means early exhaust closure and more compression, which tends to heat up his main pins.



Photographed by F. W. Blauvelt, New York.

UPTOWN TERMINUS OF THE MANHATTAN ELEVATED RAILWAY, 158TH TO 159TH STREET. HIGH BRIDGE AND WASHINGTON BRIDGE IN DISTANCE.

There is another point: It is pretty well known by this time that the steam-chest pressure never equals the boiler pressure. The writer made observations in this connection in 1879 on different classes of engines under various conditions, the result being made public by the superintendent of motive power of the railroad in question, and so far as we know, this was the first time the matter was looked into. According to the gages, there was much less pressure in the steam chest than in the boiler when the engine was working with a long cut-off and a medium throttle. In fact, when starting with a heavy load, the needle would swing back and forth 10 to 15 pounds, keeping time with the port opening. On the other hand, when at high speed with full throttle and lever cut right back, there was maintained a steady pressure of from 3 to 5 pounds less than boiler pressure. We feel assured that this was the first time the matter had been investigated, as otherwise the superintendent would not have endorsed the first report, "Steam pipe collapsed; examine." (This pipe is our dry pipe, only made of copper.) We found it was O. K., so overhauled another engine whose dry pipe was also all right, and went out with her, with similar results. The next report was endorsed, "Enlarge regulator area." We did so. Results were about the same, and having made sure that the branch steam pipes were all right, we came to the conclusion that the trouble was something that had to be put up with. Of course, nobody would expect to get as much pressure in the steam chest as in the boiler, but still we did not expect such a difference. Now, the point we were going to enlarge on is this: that when notched right up (which generally means more throttle) the pressure is heavier and steadier on the valve, and objections 1, 2 and 3 (see First Paper) are therefore more pronounced.

To return to the matter of condensation: One builder we were acquainted with, knowing it was a bad thing to let the final temperature drop so much, took steps to still further increase the compression over and above what naturally obtained with a valve whose exhaust was "line and line"; so he gave his valves inside lap, thus closing his exhaust still earlier and bottling up the steam until nearly boiler pressure was obtained by the time admission next took place. But here was another case of "overlooking things"; for although he certainly saved fuel so far as direct heat-waste went, yet the engine, owing to the above valve design and the small exhaust ports in use, seemed to "work against herself," as the men phrased it, and of course there was a loss that way.

Not only is exhaust lap rarely, if ever, used nowadays, but exhaust lead is used instead, particularly for fast-running engines. Of course, it appears, on first thought, to be absolutely essential that the valve should not allow both steam ports to be uncovered to the exhaust at the same time, and it is not this that we desire to bring about; but if we cut out the cavity of the valve so as to open the exhaust earlier (and *this* is the desideratum), it is a necessary consequence that on the return stroke it will be later closing the exhaust, and will not have closed it by the time the other exhaust has begun to open. Experience, however, which is ever the best teacher, shows that lead on the exhaust is a good thing for very high speeds.

Then again, there is the question of lead on the steam side. Early designers were aware of the desirability of filling the clearance space ready against admission, and wishing also to insure the steam being there and ready to go to work on the piston as soon as the crank passed the center, they thought that a lot of lead would be a good thing. Now, it is certainly desirable to bottle up your old steam to fill the clearance space instead of taking live steam to do so, and it is also necessary to have a certain amount of compression so as to get smooth running, but it happens that with the link motion in common use the lead *increases* as the lever is notched up, and although this increasing is desirable (it has always, in fact, seemed to us remarkable that people should regard this as a defect of Stephenson's motion), yet it is possible to have too much of a good thing, and if you start in with 3-16 inch lead you may get ½-inch or more when notched right up (the increase depending on the radius of link—that is, on the eccentric-rod length—the disposition of the eccentric rods, the throw of eccentrics, etc), and this amount is altogether too much, resulting very often in hot pins and the loss of power generally. Valves are now set in the running cut-off, giving them ⅛ to 3-16 inch lead—letting the full gear look after itself.

It is altogether a mistaken idea—that of giving an engine lead to make her smart. The turning effect on the crank is *nil* on the center, and increases only gradually as it leaves that position, so, as regards turning effect, we do not want the steam to catch the pin until it is well over the center. Early designers, then, must evidently have had in mind the fact that the port-opening was gradual, and that if they wished to get a decent opening by the time the crank was in a position to make use of it, they must open the port before the crank left the center; the amount of this prior opening was called *lead*. The above line of reasoning is one that certainly commands respect, but the idea of giving lead simply to make the engine smart in getting away is less commendable, albeit quite long-lived. Probably the casual reader may think he here perceives a distinction without a difference, but our idea in giving lead is altogether different from what we have hitherto seen given. In short, we would not try to have the port open at all when the piston is on the center (compression would take care of the momentum of parts), but would like to have a good liberal opening—and get it all at once, too—directly the crank was a few degrees past the center, where the steam can do some good. Now to achieve this, we *must* open the port early—thus getting what we call lead—but we contend that it is not for the sake of having it open when the crank is actually *on* the center. Joy's valve gear, by the way, gives the kind of motion we want—a quick opening, a quick cut-off and a quick release; the valve also dwells on the expanding and releasing phases of the stroke. Equal lead and cut-off can be obtained for both ends of a cylinder and for different grades of expansion—a thing impossible with the link motion. In addition, fewer parts are required, and the absence of eccentrics is especially valuable in inside-connected engines, as we are thereby enabled to put in larger cylinders without encroaching on the thickness of our crank webs or the length of our journals and horn blocks (*i. e.*, pedestals). In short, we can bring our cylinders nearer together, and so use larger ones.

To return, however, to the question of lead, for using which there is, of course, a practical reason: lost motion, which, in course of time, is sure to show in the valve-yoke, pins, links, blocks, etc., affects the lead. Suppose that everything is new, and that the valve is moving towards the front end; the back port will open at a certain moment. Now, if the engine could be suddenly put in the condition she will be in after, say, six months' wear, there will be all this lost motion to be taken up before the valve moves at all when changing strokes, so that if the total play is 3-32 inch the valve will be that much short of opening the port to steam at the moment mentioned. Lost motion always acts to delay the port opening, so that to get what we want under average working conditions, we must counteract the effect of this wear by setting the eccentric a little further forward than normally (or backward, in the case of a locomotive having a reversing rocker), that is, we give the engine a little lead. We may remark here that when using the Allen valve it should be remembered that the lead is virtually doubled. When the steam edge of the valve has opened the port ⅛ inch, there is ⅛-inch opening at the other end of the valve, so that we have really ¼-inch port opening. This should be borne in mind when choosing the lead, or else the port opening will be excessive in the early cut-offs. Being able to reduce the lead is advantageous in more than one way. It delays the opening of the exhaust, and so gives us more expansion, and it also delays the exhaust closure, and so decreases the compression.

Returning to the question of compression and lead: It is necessary to have the ports and passages filled with steam by the time the crank turns the center, for two reasons: By emptying them entirely we drop the temperature a lot, and this causes the new steam coming in to meet with a "cool reception," and further, the port opens but slowly at best, and therefore if the incoming steam has to fill up all the passages and clearance before it gets to the piston there will be a loss of effect. And, as we remarked before, we want a cushion to take some of the strain (due to momentum of parts) off the pins. Compression plays no part whatever in balancing an engine, although many think the contrary; but it *does* conduce to smooth running. Now, the point we make is simply this: that the above advantages will be brought about in the ordinary course of things—by compression. Shortening the travel of a slide valve not only gives us an earlier cut-off, but also an earlier exhaust closure. This gives us the compression we want—too much sometimes, as is evident from the benefit resulting from giving inside clearance to the valves of high-speed engines.

When, then, instead of leaving the valve gear to bring about the above condition of things at the commencement of stroke, designers go and give a lot of lead, and not only do that (forgetting, perhaps, how it may increase toward mid gear), but also use inside lap, there need be no surprise felt at the number of engines that are sluggish or that "won't run free."

The best practice, in fact, is to give an engine a suitable lead in the running cut-off; this often requires the valve to be line-and-line in full gear, that is, without any lead at all. Often, indeed, the port is blind when the crank is on the center; that is, the valve has yet some distance to go before it opens to steam at all. The amount of this negative lead (as it is termed) varies from 1-16 to 3-16 inch.

Machinery and Transportation Building of the Pan-American Exposition.

This building is to be 500 by 350 feet, and is designed in a type of Spanish Renaissance, with initial inspiration in the Mission buildings found in Mexico and California, supplemented by later examinations of Renaissance work in Spain, modified to suit the conditions of the Exposition with its gay and festive surroundings.

Briefly stated, the machinery and transportation buildings form a hollow square, with arcades on all sides. In the interior is a court 100 x 200 feet, adorned by a long pool of water, with a fountain surrounded with shrubs and flowers, artistically planted. This sheet of water, with its calm reflection and its atmosphere of quiet restfulness, forms one of the many little oases planned for the refreshment of the weary sightseer.

If we add to the traveler's description that the roofs are of red tile, the walls of cement, the work is more ornamented, the structure covered with glowing colors, we have briefly a correct description of this building.

The facades present an arcaded effect corresponding in appearance to mission cloisters; the eaves with great overhangs, add to the picturesque. Each facade is broken by an important architectural feature, and each corner flanked with low pavilions, the design giving large plain surfaces for color, while the eaves give deep shadows. The color scheme is made up in reds and yellows, light in tint.

MACHINERY AND TRANSPORTATION BUILDING, PAN-AMERICAN EXPOSITION, TO BE HELD NEAR BUFFALO IN 1901.

The building has numerous entrances, the principal ones being in the center of the four facades. Once inside the structures the size will be appreciated.

Uncle Billy on Compounds.

Uncle Billy was holding forth in the oil room, where he presided, as Jed Brewster happened along, and Jed told it to me as he remembered it—and I guess it's pretty near straight, too.

" 'Taint no use kicking 'bout the compounds, boys; now, you listen to me and hear my tale o' woe, and see if 'tis. If somtone had knocked that ijee of bucking everything new outer my head 'way back in the late fifties, I might not be a counting out oil by the drop to such a gang as this.

"I went to railroading firing wood, and the c al burner didn't have no friends, I tell ye. Only a few of the boys wanted to touch the coal burners, but they kept coming, and being newer and heavier engines, got the best runs. Then we wood burners kicked because the other fellers had the best runs.

"Then the injectors commenced to come, and we kicked again; pumps was good enough for us; and once more the chaps that took hold and learned how to handle the thing kept getting ahead.

"You'd a thought we might have had sense after that, but we didn't, and when the air brake came we bucked just the same, and with the same result—the best air-brake men ran passenger while we hauled freight.

"The change from straight air to automatic caught us again, and probably if they hadn't retired me from active service I'd be doing just as you are—kicking about compounds.

"But I told my boy only this morning, sez I, 'Jimmy, you learn to run any bloomin' thing on wheels they bring on the road, no matter if the wheels are three-cornered, if there are four stacks and two boilers—run it just the best you know how. If you don't, someone else will, and the master mechanic'll say: "Well, Jimmy Kerrigan couldn't handle the '840.' Guess I'll keep him switching in the yard." ' Sez I, 'If you can't run anything that some other feller can, and do it just as well, you're no son of mine—and the railroad wants the man who can do the best work. Don't think you can kill the ijee by not running it as good as you can, for there'll always be someone that can and will. Run the thing just the best you can, and if it fails, it isn't your fault; but if the other feller can get good results and you don't, it's the fault of the man, not the machine.' "

Jed said he had heard all he wanted to, and he was going to run one of those new compounds or bust—p'raps both—and I think myself Uncle Billy had the big end of the argument.

Getting a New Hat.

'Twas at the New England Railroad Club, and most of the guests had departed, when Potter—he of the famous Ghost train of the old New England railroad days—told us about losing his hat.

"I was out the other night, and being one of the last to leave the only hat I could find was a $6\frac{7}{8}$. As I wear a $7\frac{1}{8}$, it wasn't an exact fit, you see, and my wife jollied me about having a swelled head when I got home.

"My own hat wasn't new, and the other one was, but it looked like a tin can on a pumpkin, so I couldn't wear it.

"Then I discovered the name of the hatters, good name, too—so I put on the hat and walked down there.

"I pretended to be mad, of course—asked the proprietor if he called that a fit, and made sundry other polite remarks.

"'Who sold you that hat,' said he; 'wouldn't have had a case like that go out of here for anything.'

"'Didn't think you'd call it right,' said I, and then he hustled around and fitted me with one of the best hats I ever had.

"I'm waiting till this wears out, and then if any fellow wants to swap again I'm willing."

Predictions are Dangerous.

A correspondent writes: "In looking over the issue of the *Electrical World* for 1895 I found the enclosed article. Has this prediction been verified, and where? Thanking you for your kindness in advance, I remain W. S. Chase.

"*Los Angeles, Cal.*"

The clipping is as follows, and is from the *Electrical World* of March 9, 1895:

PERHAPS NOT SANGUINE ENOUGH.

"According to the Philadelphia *Ledger's* correspondent from Harrisburg, concerning the doings of the State legislature, it has been predicted that in the year 1899 the legislators will be taken from Philadelphia to Harrisburg by trains operated by electric energy. How this exact date has been determined we do not know, but we venture to predict that on those existing steam roads, on which there is a very large passenger traffic between two large cities, not much over 100 miles apart, the substitution of electric traction will be made before that year. The change is so easily made, and the advantages and economy can doubtless be shown to be so great, that it will probably require only a few practical demonstrations, which are now beginning to be made, before the number of roads to take advantage of this improvement will increase in geometric ratio."

Comment is almost unnecessary, as the changes so far are confined to short runs with light trains on suburban roads, and the old locomotive is pegging along from Philadelphia to Harrisburg and elsewhere as before. We don't deny that electricity has its field, but up to the present it doesn't embrace trunk lines.

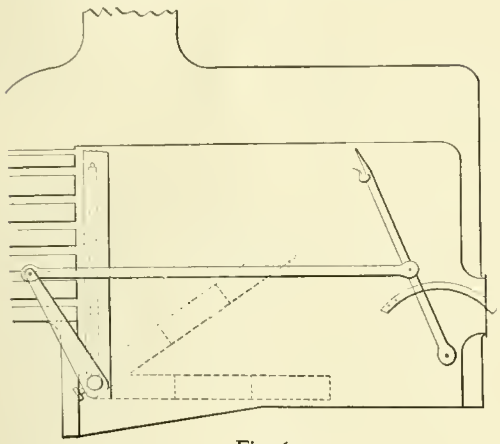
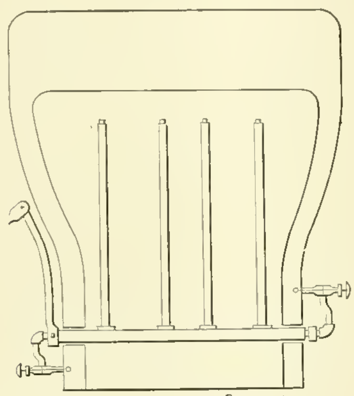


Fig. 1



Locomotive Engineering

Fig. 2

Adjustable Brick Arch.

The annexed illustration shows a form of brick arch proposed by Mr. Ed. Sarver, Deadwood, S. Dak. The idea is a good one, and might prove of great usefulness to railroad companies if carried out. The arch could be adjusted to the position in which it was found the engine steamed best, which is no small consideration. Then when work had to be done on the tubes, the arch could be lowered out of the way and the costly operation of knocking down the arch and building a new one avoided. When the fire is drawn the arch could be folded up close to the tube chest, which would prevent the flow of cold air through the tubes, which so often starts leakage. We should like very much to see someone give this arch a trial.

What Makes Iron Scarce?

A writer in a Knoxville (Tenn.) daily paper states it as his belief that one of the causes for the present scarcity of iron is the fact that a large proportion of iron now used goes into buildings, bridges, vessels, etc., as structural iron or steel, none of which gets back to the mills as scrap, at least not for one or two generations of man. What has been put into buildings has not likely returned yet, unless the buildings have been destroyed by fire or otherwise. Iron vessels that sink or are wrecked are out of the scrap iron market.

On the other hand, he states that a large proportion of the iron, both cast and wrought, that goes to railroads, manufacturers and the general consumer in the shape of engines, cars, machinery, farm implements, etc., gets back to the mills and foundries in the shape of scrap, and begins its course over again.

Maybe he is right, but structural iron or steel has been used extensively for a good many years. The tremendous increase in building operations, both in structures and machinery of all kinds in the last three years has used up the manufactured product faster than it could be made from the ore, in spite of the increase of the output of the mines. The price of iron is said to be a thermometer of business acitvity. If such is the case, it does not entirely depend on the amount of old material that comes back. There is sufficient iron ore in sight to last the demands of the country for many centuries.

Incident of the Philippine War.

People who read mechanical papers are likely to be familiar with the name of James W. See, an engineering expert who years ago wrote a series of most amusing and instructive articles on mechanical subjects, which he called "Chordal's Letters." The letters read like a romance. An item in a recent Cincinnati paper tells a curious incident in which a son of Mr. See figures. It says:

"A letter just received by Robert Hurm, of this city, from a young Hamilton soldier, now serving in the Philippines, brings the story of a remarkable coincidence in the capture of Paca. The writer was one of the first into the town after the enemy had been dislodged, and the soldiers at once began ransacking the native "shacks." In the first hut he entered the soldier saw a familiar photograph. On examining it he found that it was a picture made by Overpeck, of this city, ten years ago, of Robert See, son of James W. See, the Hamilton engineering expert, and of Clifford Grapes, who was widely known in this locality in the eighties, as a juvenile military expert. Both lads were in their cadet uniforms. How the picture found its way into a Filipino camp 9,000 miles away from Hamilton is not known. It is surmised that young Grapes may be serving in the Philippines and that he was possibly taken with the picture on his person.

The problem of the weight of rail necessary to support a given weight of engine is one on which we have comparatively little reliable data. The economical weight is also an important question.

Locomotive Engineering

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Examination of Enginemen.

Although all the railroads of any importance now require that firemen shall pass an examination before being considered eligible for promotion to the position of engineer, there is great reluctance shown by many of the men concernéd in beginning to prepare themselves to answer the questions that will certainly be asked. The examination is rarely difficult, the examiner merely wishing to find out if the candidate for promotion has learned enough about the engine and about air brakes to be trusted with the care of a locomotive and with the safe handling of trains. The simplicity of the questions asked seems sometimes to embarrass the man under examination. We heard of a case that happened lately where the first question asked was: What is the signal for calling in a flagman? Although the man had been firing five years he could not answer that simple question. On being cross-examined about his ignorance of such a simple and practical matter, he answered that he had never paid any attention to whistle signals as it was not his business.

A very important line of examination aims at finding out whether the candidate knows what ought to be done in case of breakage to the machinery which disables one side of the engine. There was once a time when a fireman in the course of five years' experience would see nearly all kinds of breakdowns and would learn by seeing what the engineer did to put the engine in running order, the best plan for himself to adopt when he had to deal with a similar accident. But nowadays failures of machinery on the road are so rare that a fireman may have five or six years' experience on the road without seeing a main rod taken down. On this account it is absolutely essential that firemen should be taught in a theoretical fashion how best to deal with accidents to an engine on the road under their charge, for although breakdowns are now very rare, the unexpected may be depended upon to happen at any time.

A party of passenger train engineers were in this office recently, and they got discussing the subject of examining firemen for promotion and the examining of engineers who were applicants for employment on strange roads. The general opinion expressed at first was to the effect that the examination arranged by the Traveling Engineers' Association and published with answers in the last edition of Sinclair's "Locomotive Engine Running and Management" is too hard for ordinary men. We took up the book and went over a lot of questions taken at random, but none of those who had raised objections to the Traveling Engineers' Association examination as a whole could point to anything objectionable in detail.

The aim of the questions is to find out if a man knows enough about the handling and construction of a locomotive to manage it properly under all circumstances. It is no matter how he answers the questions, so long as he knows what they mean and displays practical acquaintance with the problems involved. One of the first questions asked is "What are the first duties of an engineer on reaching the engine he is going to take out?" The fireman who has merely his habits of observation to draw from will answer this question by describing the habits of the engineer he has fired for longest and admires the most. In this case the fireman might answer: "Shout to the fireman to hand me down the oil can and then begin oiling round." That would not be considered a satisfactory answer, although it describes the practice of a great many engineers. Merely to talk of oiling round and then starting out is not really describing any of the important duties that an engineer should perform before starting with an engine. But there are so many who merely do that that it is natural that no more particulars should be given when an engineer of this stripe falls out of a job and is examined by the officials of a road where he is an applicant for employment.

There are periodical revivals of interest in the locomotive engineer out of a job, and a great deal of sympathy has been extended to those who had to resort to menial employment because they had failed to secure work again running a locomotive. We have given such men more than sympathy, and entered into a systematic search for railroads that were hiring men to run locomotives. This enabled us to recommend quite a number of locomotive engineers to report to certain master mechanics. Some were hired on the letters and recommendations they carried, but others were subjected to an examination to test their knowledge of train mechanism and of railroad work generally. In most cases these men failed to obtain positions, because they could not prove that they knew anything about locomotive management or air-brake mechanism. Instead of availing themselves of the opportunity to study for a few days and try again, most of them departed with bitterness in their hearts and on their tongues abuse of the so-called impractical officials who were not contented with an engineer so long as he knew how to start and stop a locomotive. That does not now cover the accomplishments required of a locomotive engineer, and every year will see the demand for knowledge besides experience extended.

Assistance of Higher Railway Officials Needed.

While the condition of air brakes on motive power and equipment to-day is not as good as could perhaps be wished for, still the work which has been thus far accomplished is largely due to the efforts of the Air-Brake Association and Traveling Engineers' Association. The members of these organizations are the men who are most closely brought in contact with the equipment, manipulation and maintenance of brakes on motive-power and rolling stock. It is to them, therefore, that the busy higher official must look for detailed and authentic information on air-brake equipment, just as he looks to heads for information concerning each other department.

Although much yet remains to be done, it must not be implied that little has been thus far accomplished. On the contrary, much has been done. The whole work has been enormous. This makes, by comparison, the accomplished work seem unduly great. But it must be followed up energetically and constantly. A continual driving with systematic plans and organized departments under the direction of competent men, and the whole truly supported by the officials in both the motive power and transportation, is necessary to bring the desired good results.

The air-brake men and traveling engineers are in almost every case doing their individual part. They attend the conventions of their associations (some at their own expense, it is to be deplored), receive and exchange ideas from the discussion of pertinent subjects and their association with other members, and the benefits are brought home and placed to the advantage of the road. It is but just, therefore, that these men should be permitted and encouraged to attend the conventions, and that the earnest and hearty support of higher officials be given these younger associations which, with the railroad clubs, serve as most valuable feeders to the General Managers', Master Car Builders', Master Mechanics' and other older and higher associations.

One of the most effective ways for higher officials to assist in the good work sought by the younger associations is to encourage their air-brake men and traveling engineers to become members and induce them to attend the conventions. The outlay is trifling and the return very considerable.

The Traveling Engineers do not meet until next September. The Air-Brake Men, however, meet in Jacksonville, Fla., April 3, and every man who has to do with either the equipment or maintenance of air brakes should attend. The higher railway official, by sending the right man, will bring manyfold benefits to his road by granting leaves of absence, transportation, and otherwise giving assistance as above mentioned.

Beware of the Inventing Craze.

The writer once had supervision over a machinist, Morgan, who was a very good workman and did his work very satisfactorily, needing no watching concerning the quantity or quality of the work turned out. One day an engine came in with an injector that persistently failed to send water into the boiler, and the combined wisdom and experience of the shop was consulted to diagnose the cause of failure. Some of us were fairly familiar with injectors, and after a thorough examination of this one we were inclined to sympathize with the answer given by a marine engineer under examination to questions about a pump. The examiner said, "Now, suppose you had a pump that persistently refused to work. You took it apart and carefully examined every piece, followed its connections from the sea connection to the boiler check valve, and found everything all right, yet the pump would not throw water. What would you do?" "I would go on deck," replied the candidate for advancement, "and find out if there was any water in the sea." It seemed for a time to be a similar case with our injector, but after being nearly beaten we found that there was a sliver in the delivery pipe, which broke the stream of water and prevented the injector from working. When that defect was remedied there was no more trouble with that injector.

While the excitement was prevailing about that injector my man Morgan was very zealous, and had more than his proper share to say about what was causing the trouble. He took the ground that the injector was not made properly, and that it always would be defective. He could repair an injector or any other engine attachment by bringing them as nearly as possible to the original forms, yet he had no knowledge whatever of induced currents or of the fundamental principles on which injectors, steam gages, air pumps, or other appliances, were designed. Nevertheless an idea entered his head that he could invent and make an injector that would be superior to anything on the market. From that day he had injector on the brain, and neglected his work to sit cogitating about his forthcoming invention, and later to work on it by stealth. We endured his hallucination, thinking it would be short-lived. The injector was duly finished and tried, but would not work. It was altered and tinkered at for weeks, and it finally consented to send a feeble stream of water into the boiler. That turned Morgan's head. He had become an inventor, and all he needed was a patent on the injector to make his fortune and that of all his friends. It was not an easy matter raising the money to pay for patent papers, but the widows and orphans of the church he belonged to contributed their mite to a company formed to exploit the invention, and application for the patent was made. The modern up-to-date patent lawyer who will obtain a patent on anything had not come to the front then, and Morgan's invention was refused on the grounds of lack of novelty.

Morgan stamped, and protested as vigorously as a church member could that a poor man could not receive justice from the patent office scoundrels, and became a man with a grievance. From being a fairly pleasant man to have intercourse with he became a one-idea misanthrope, with a snarling, discontented manner. He could not disagree with a man without insulting him. Instead of attending to his work he was always looking for someone to listen to his tale of woe. Remonstrance was useless. He was steadily demoralizing the shop force, and it was considered necessary to discharge him. On his way home he had to cross over a bridge spanning a great gulley with a rapid river at the bottom. He jumped off this bridge and ended a career ruined by the allurement of becoming an inventor.

Injector Piping on Modern Engines.

The injector is, without doubt, one of the most important features of a locomotive, and when it fails to work there is trouble ahead for all hands. With the knowledge of its importance it is a matter of surprise that more attention is not paid to the piping on many of our new large engines. Bends in the pipe, half turns at times, seem to be considered of no moment, and even the size of the pipe is restricted as much as possible.

Leaving out of the question the convenience of location to the engineer, the precautions necessary to its successful working at all times are often overlooked.

Twenty years ago the maximum capacity of the injector we used most was about 1,900 gallons, and it had a 2-inch pipe, too. To-day we are using larger injectors with the same size pipe, and the capacity increased to 3,450 gallons per hour, with the same steam pressure. Yet we are using the same size piping as before and paying no more attention to crooks and curves than formerly.

We want the best results from every part of the engine, and this is one point that should have careful attention.

The Locomotive Engineer.

That part of the people called the public, and which is never brought in actual contact with the railroad engineer, necessarily receive their only impressions of him from occasional daily newspaper accounts of wrecks, accidents and descriptions of fast runs, and see him only in the grotesque pictures of magazine articles and horribly caricatured pictures of sensational dailies.

He is known to the newspaper public as the engineer who, "seeing the child on the track but a hundred feet ahead, blew the locomotive whistle, and by promptly reversing his brakes, stopped the swiftly flying train in a car's length and saved the innocent toddler," etc.; or, "seeing that a collision was imminent, the engineer 'jammed down' his throttle hard, 'ground on' his air brakes, 'reversed' his engine bar and rode calmly into death." Thus he is foolishly described as an unreal thing—a being without color or character.

Nor are the pictures more kindly to him. A horror-stricken, agonized, deep-lined face, as often pictured protruding from the left cab window as the right, shows him peering ahead of a frightfully nondescript locomotive whose cylinder cocks send a steam cloud over the top of the cab, and impossible driving wheels raise a dense cloud of dust which encircles the form leaning out of the window. Sometimes the figure of a being, clad in a style of overalls never existing elsewhere than in the imaginative brain of the artist (?), is shown holding for dear life on to a crowbar-like thing intended for the reverse lever. The fire door is located near the top of the boiler head, and the throttle is either under the fire door or at the side of it. The cab lamp could easily be mistaken for either an oil can or a cider jug. The other cab fixtures are equally unrecognizable. This picture is named "Dan O'Houlihan Driving the Limited State Express Ninety Miles an Hour."

Were we privileged to do so, we would gladly undeceive the credulous public in respect to the locomotive engineer, this really able and intelligent fellow, and make them better acquainted with him. We would take them some evening to his cozy home, which he owns, and where we would receive the heartiest welcome and most genuine, hospitable reception. Perhaps he would tell us of his early struggles and point with pride to the well-furnished home, and particularly to the small library of well-selected mechanical and railway books. We would learn that he is a student and is surprisingly well up on link-valve motion, air brakes and general engine construction; also that he can talk on current events transpiring both at home and abroad. He will speak softly, and even pathetically, of the invaluable sympathy and encouragement of his matronly young wife in their life struggles. He will point proudly to his bright-faced children across the table by their mother's side, tell of their high standing in school studies and how, when they are prepared, they shall have a college education if it takes his last dollar. "They shall begin life's struggle better equipped than I did." he asserts, with a beaming of his intelligent face and a sparkling eye, which we cannot associate, however hard we try, with the pictures of the distorted, harsh face peering ahead out of the cab window or Dan clinging to the crowbar lever in the nightmare cab. We would see him laugh grimly as he read the newspaper clippings of engineers "reversing brakes" and "jamming down" throttles, and he would turn away from the rank counterfeit pictures of the harsh-featured individual and Dan O'Houlihan in the newspaper and magazine.

This is the real locomotive engineer of to-day—a man of intelligence and character, whom we intimately know, for whom we can vouch, and whom we only a few days ago wished a Merry Christmas and a Happy New Year.

How to Give a Young Man a Good Start on a Railroad Career.

Mr. J. T. Harahan, general manager of the Illinois Central Railroad, is known to be one of the most capable railroad managers in the country. Like most other railroad managers now wearing gray hairs, he learned the business by "hard knocks," and rose step by step through the forces of genuine ability and push. Like many others who have won high position through hard work and tenacity of purpose, Mr. Harahan would prefer an easier way if he had to make the upward journey over again, and he has been telling through the *Saturday Evening Post*, of Philadelphia, his ideas concerning the best training for one ambitious to become a railroad manager. Among many other good things he says:

"If I were hard pushed for a definite statement of my ideas of the steps a young man should take to become the general manager of a railroad I shoud certainly reply by going a little into the field of personality. I take it that a man will carefully consider anything which vitally relates to so important a matter as the life career of his own son; and it happens that I have a son whom I hope to see in the position of general manager of a railroad. This circumstance brought home to me, in the most serious and personal manner possible, the question just proposed, and I answered it by sending the young man, after he had obtained a good general education, to a first-class technical school. When he was graduated from this institution he was well grounded in the theory of mechanical and civil engineering. Of course, it might have seemed pleasanter to him to have at once stepped into a position of some little dignity and responsibility. But a genuine railroad man is not made by high jumps, particularly at the beginning of his career. He joined a surveying party in the humblest capacity and "carried chain" for many months. When fitted by experience for his first promotion he was given a transit and the other surveying instruments, and took a more responsible part in laying out a new line of railroad. Before this experience was over he knew something about how the roadbed of a railway is planned and constructed.

"Then, for the sake of broadening his experience, he was transferred to the shops. There he put on a mechanic's apron, was assigned a lathe and bench, and gradually learned, by hard and honest labor, the practical side of locomotive and car construction. All this time he was being brought into constant contact with the working force of the road—the surveyors, the navvies of the gravel train, the bridge builders, the section hands, the conductors, engineers and firemen, the machinists and the mechanics in every department of car and locomotive building. With many of these he naturally and inevitably established associations of fellowship which gave him a close insight into their lives, and enabled him to see the problem from their viewpoint. After a protracted experience in the shops, he was offered a position as roadmaster in the service of an Eastern line. Here was his opportunity to bring into play a new faculty—that of getting others to do things, and to do them in accordance with his ideas as expressed in orders and suggestions.

"He won the confidence and approval of his employers in his first executive position. I knew that he was well grounded in the technical knowledge of his calling, that he had seasoned this theoretical knowledge by practical experience and hard work in the fundamental lines of the business, and I hired him as a division superintendent, as I would have hired any other young man of whom I knew the same things. This statement will, at least to a degree, answer the question of how I would start a young man on the road to become a general manager.

"Probably a very large proportion of the men to-day holding positions as general managers of railroads will be compelled to share with me a regret that circumstances did not permit them to lay the basis of a sound technical education before entering the sterner school of experience in the actual service. Certainly I have felt such a regret very forcibly; my own training was wholly and severely practical, and in that particular is probably not different from the experience of most men holding similar positions.

"It is to be taken for granted that no man will be advanced to a responsible and important railway position without displaying in reasonable measure that capacity for practical affairs commonly called executive ability; but there are special qualities which seem to me very essential for this service. The man who does not possess them has not in him the making of a good railroad man."

Weak Brakes on British Freight Cars.

In the Transvaal war the officers of the British War Department have been several times badly embarrassed by the want of braking power common to nearly all European freight cars. The braking power of an English "wagon," as the freight cars are called, consists of a horizontal lever connecting with a bell crank which carries a brake shoe. To apply the brake the lever is released by hand from the catch which holds it up, and that lets the brake shoe rub upon the wheel. If extra braking power is wanted a man stands upon the lever. These brakes are not used for stopping trains, only for controlling the cars in yards. This lack of braking power led to the loss of a valuable train of supplies in South Africa lately. A correspondent, describing the incident, writes:

"At Colesburg the other day a lot of railroad trucks loaded with foodstuffs got away from the British and lit out down the heavy grade track as fast as they could turn a wheel for the Boer lines at the foot of the hills. A detachment of British soldiers undertook to reclaim the valuable cargo, but were shelled back to their lines by the watchful Boers. At last accounts neither side had been able to get the goods.

The International Correspondence School people of Scranton, Pa., are giving a great many object lessons to attract students to their establishment. One of their latest enterprises is publishing in the "Scientific American" pictures of their beautiful building at Scranton and a number of views showing what is going on in a variety of rooms. There is a big instruction department with numerous students seen at work; correcting department, where an attractive collection of young ladies are correcting papers; a big mailing room, a laboratory and several other rooms, showing in graphic shape the work of this fine establishment.

BOOK NOTICES.

"Fowler's Mechanical Engineer's Pocket-Book for 1900." This is a useful book of reference published by D. Van Nostrand Company, New York. It contains a tremendous amount of data relating to engineering subjects, and is kept well up to the mark. It is beyond the space available to even mention the principal subjects treated by the book. There is a good deal in it about electricity, about steam engines, turbines and other methods of originating and transmitting power. The book is sold for $1, and seems to be well worth the money to anyone interested in engineering subjects.

The Locomotive of To-day. The Locomotive Magazine. London. Price, $1.

This is reprinted, with numerous revisions and additions, from the recent issues of the *Locomotive Magazine,* and may be said to represent modern practice in English locomotive building, although some attention is paid to the engines of this country. Beginning with the boiler, the different details of the engines are shown, and though few dimensions are given, the drawings are probably to scale, and a good idea of proportions can be obtained. In addition to the line cuts there are several good half-tones of the leading engines, and, taken as a whole, we believe it is a book which those interested in locomotive design will want to possess. It is well printed on good paper and bound in a substantial manner.

Power Transmitted by Electricity.

The above is the name of a book recently published by the D. Van Nostrand Company, New York. The author is Philip Atkinson, who is a well-known writer on electrical matters. The design of the book is to give in plain and untechnical language the essential facts in regard to the means by which electricity is employed as an agent for the transformation and transmission of power and its application to the operation of machinery. These comprehend the construction and principles of the electric motor and its relations to the dynamo and through it to the steam engine and other sources of power. The facts which the author has to state are very plainly given, and will form a very good hand-book for foremen and others in charge of machinery, where the old-fashioned methods of transmitting power are being dispensed with and electric motors put in their places. To people who are not familiar with the electrical transmission of power and the mechanism connected therewith, we cordially recommend the book as a reliable reference. The price is $2.

We are informed that the Baldwin Locomotive Works are now employing 7,300 men. It is difficult to realize that so many men can be building locomotives in one establishment.

Engineering Rules and Instructions.

The above is the title of a small "pocket companion" sort of book recently published by the *Engineering News,* New York. Several years ago Mr. E. H. McHenry, chief engineer of the Northern Pacific, prepared a code of rules for the instruction and guidance of the engineering department of the Northern Pacific Railroad, and the book before us is a copy of these rules, published by permission of the author. Although the book is small and sells for 50 cents, it contains a wonderful amount of information and instruction. Mr. McHenry says that "enginering is the art of making a dollar earn the most interest," which may be regarded as the text of the treatise.

The instructions are given under seven headings, and comprise: Organization; Location; Surveys and Construction; Track and Ballast; Bridges and Culverts; Accounting and Miscellaneous; finally, Supplies. The book should be in the hands of every railroad official connected with the operating or enginering departments.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(15) W. R. H., Terre Haute, Ind., asks:

Is the 232,200-pound Illinois Central engine the largest in the world? A.—We believe it is at present. The reference to "wheel feed," etc., in the November issue was an error. It should be "wheel fit," as you suggest.

(16) M. G., Mexico, asks:

What is the capacity of the Brooks twelve-wheel engine for the Illinois Central railway? A.—Cylinders, 23 by 30; driving wheels, 57 inches, and 85 per cent. of the steam pressure (200 pounds) gives a drawbar pull of 45,000 pounds. At 25 miles an hour on the level it could haul 5,000 tons, according to calculations.

(17) G. J. C., Collinwood, O., writes:

There has been considerable discussion over "What controls the valve." A.—This is rather an indefinite question, and can be answered in several ways. The valve is operated by the link, the link by the eccentrics through the eccentric rods, and the whole thing is controlled by the engineer operating the reverse lever.

(18) W. J. W., Baraboo:

An 18 x 24 eight-wheel engine on a light three-car train; eccentrics and straps badly worn, and ratchet on reverse lever also worn some. Engine was running about 20 miles an hour and suddenly lever went into back motion. Engine was working at 6-inch cut-off at the time. What was the cause? A.—As there is a *forward* pull on the reach rod when running ahead, it is evident there was something caught in the steam chest, or else something hit part of the valve gear from some cause or other.

(19) D. B., New Orleans, writes:

We have a Nathan lubricator on one of our engines that cannot be oiled through one of the cups while the engine is drifting, on account of steam escaping. The one opposite is all right. What causes the trouble? A.—The trouble complained of points to the existence of an obstruction in the tallow pipe, which prevents the steam from blowing down the pipe with sufficient freedom. Such an obstruction causes a back pressure which sends the steam through the auxiliary hand-oiler whenever the latter is opened.

(20) W. B. G., Fort Worth, Tex., asks:

What per cent. of the surface of a bearing, such as a driving box, is figured as supporting the load, and what is the usual pressure allowed per square inch? A.—It is now customary to take the "projected area" of a bearing as the supporting surface. This is the area projected or drawn from the diameter of the journal and the length of the bearing. Take the case of the recent Illinois Central consolidations, and the driver bearings are 9 x 13 inches. Multiplying 9 by 13 gives 117 square inches as the projected area. The load on each wheel is 24,750 pounds. Dividing this by 117 gives 211.5 pounds per square inch. The pressure allowed varies according to designers, but this probably represents modern practice as well as anything.

Some Recent Record Sheets from the Wabash Railroad.

We have been favored with a little correspondence between the Wabash Railroad and the Richmond Locomotive and Machine Company, which is interesting as showing the recent performance of modern simple engines and compounds. It will be noted that of the simple engines there is practically no choice between the two makes of engines.

The cost of repairs is shown not to be materially higher in the case of the compounds than with simple engines, in fact only 9 cents per hundred miles in this case. The next performance sheet speaks for itself.

The Wabash Railroad Company.
Office J. Ramsey, Jr.,
Vice-Pres't & Gen'l Mgr.

St. Louis, Mo., December 8, 1899.

Mr. R. W. Williams, Secy. Richmond Locomotive and Machine Works, Richmond, Va.:

Dear Sir—Replying to your letter of the 6th inst., I beg to inclose herewith a copy of a statement showing performance class "G" engines that were put into service May and June, 1898, showing a comparison as between the simple and compound engines. This statement shows the cost per 100 miles run for repairs, and the average miles run per ton of coal. The repair account includes all repairs of whatsoever nature and cause, including casualties. I presume an absolutely fair statement, showing the comparison of the relative expense of simple and compound engines should show the repairs to the valve motion exclusively, but this information we have not separate from the other items. However, I think these figures will give a fair idea as to the relative cheapness of the two types of engines in the matter of repairs.

Yours truly,
[Signed] J. RAMSEY, JR.,
Vice-Pres't and Gen'l Manager.

The Wabash Railroad Company.
Office J. Ramsey, Jr.,
Vice-Pres't & Gen'l Mgr.
St. Louis, Mo., October 17, 1899.

The Richmond Locomotive and Machine Works, Richmond, Va.:

Gentlemen—As requested in your favor of the 2d inst., I inclose herewith statement of the performance of our "Richmond" compound engines compared with the performance of simple engines, for the period from June, 1898, to March, 1899, inclusive.

The figures speak for themselves.

Yours very truly,
[Signed] J. RAMSEY, JR.

The principal dimensions of the ngine shown are:

Weight on drivers—120,200 pounds.

Weight in working order—157,100 pounds.

Wheel-base, driving—14 feet.

Wheel-base, total engine and tender—46 feet 7¾ inches.

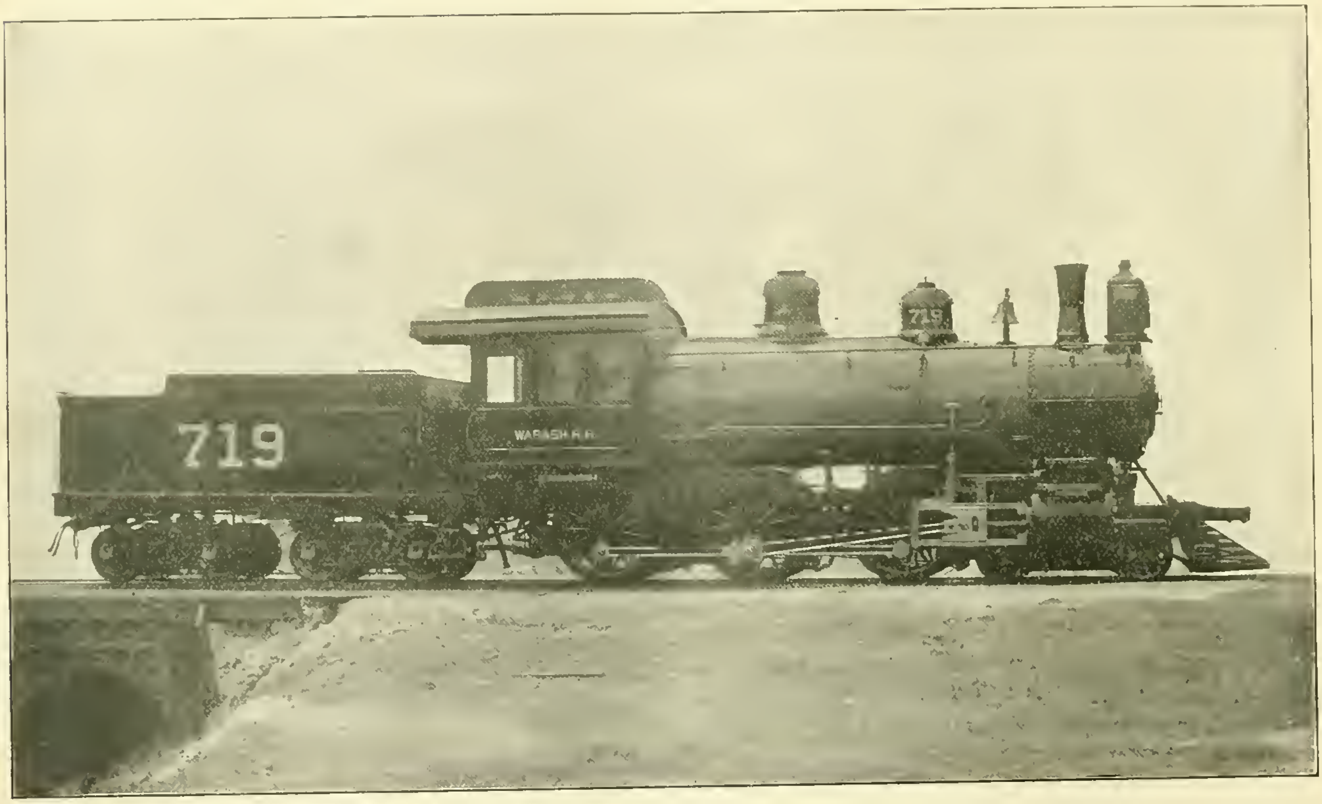
Total length of engine and tender—56 feet 10¾ inches.

Diameter of cylinders—20½ and 32½ x 26 inches.

Greatest travel of valve—H. P., 6 inches; L. P., 6½ inches.

Lap, outside—1⅛ inches.

Lap, inside clearance—H. P., ¼ inch; L. P., 5-16 inch.



ONE OF THE RICHMOND ENGINES ON THE WABASH RAILROAD.

PERFORMANCE OF CLASS "G" ENGINES—SIMPLE VS. COMPOUND—JUNE, 1898, TO MARCH, 1899, INCLUSIVE.

	Simple	Compound
Total engine mileage.	433,528	141,308
Total car mileage....	12,560,282	4,136,773
Total coal consumed.	37,622	9,928
Aver. cars per train..	29.0	29.3
Average lbs. coal per car mile...........	6.0	4.8
Eastern Division.		
Aver. cars per train..	27.3	28.9
Average lbs. coal per car mile...........	6.9	5.3
Middle Division.		
Aver. cars per train..	29.7	29.5
Average lbs. coal per car mile...........	5.6	4.5

NEW ENGINE PERFORMANCE

(From date received and including June 30, 1899.)

SIMPLE ENGINES.

Eng.	Repairs.	Cost per 100 Miles.	Mileage.	Tons Coal.	Av Miles per Ton.	Remarks.
701	2480.28	5.30	46814	3918	11.9	Baldwin.
702	1694.03	3.94	43021	3340	12.9	"
703	2894.99	6.70	43196	3263	13.2	"
704	2788.03	7.12	39137	3301	11.9	"
705	1219.63	3.09	39499	3350	11.8	"
711	1622.53	3.50	46392	3609	12.9	Richmond.
712	2912.42	7.02	41464	3298	12.6	"
713	3085.26	9.19	33562	3025	11.1	"
714	1917.54	4.72	40598	3733	10.9	"
715	3023.43	7.89	38332	2929	13.1	"
Tot'l	23638.14	5.74	412015	33766	12.2	

COMPOUND ENGINES.

Eng.	Repairs.	Cost per 100 Miles.	Mileage.	Tons Coal.	Av Miles per Ton.	Remarks.
716	1660.72	4.00	41553	2721	15.3	Richmond.
717	2460.53	5.84	42107	2617	16.1	"
718	2993.08	7.79	38438	2473	15.5	"
Tot'l	7114.33	5.83	122098	7811	15.6	

Lead in full gear—1-32 inch.

Driving wheels, diameter—63 inches.

Driving axle journal—8 x 10 inches.

Crank-pin, main—6½ x 5⅜ inches and 6¼ x 5¼ inches.

Boiler—Wagon-top, rad. stayed.

Boiler, working pressure—200 pounds.

Boiler, outside diameter, first course—62 inches.

Boiler, thickness of plates in barrel—⅝ inch.

Boiler, thickness of plates, roof and sides—⅝ inch.

Firebox, length—101½ inches.

Firebox, width—42¼ inches.

Tubes, number—300, 2 inches diameter.

Heating surface, tubes—2,237 square feet.

Heating surface, firebox—178 square feet.

Heating surface, total—2,415 square feet.

Grate area—29.7 feet.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The First Air Brake—A Short History; Also Reminiscences of Its First Engineer.

The first train controlled by air brakes in America, and doubtless in the world, was a local passenger train on the Pan Handle Railroad in April, 1869. Early in the spring of that year arrangements were made with Mr. W. W. Card, superintendent of the Pittsburgh, Cincinnati & St. Louis Railway, by Mr. George Westinghouse to try his brake. The brake was of the "straight air" form that had recently been patented by Mr. Westinghouse. The train was the Steubenville accommodation, and it made a round trip of 86 miles each day between Steubenville, Ohio, and Pittsburgh, Pa.

The engineer of this train was Daniel P. Tait, afterwards road foreman of engines, and now general foreman of the shops at Steubenville, Ohio. Mr. Johnson Mooney, of Steubenville, Ohio, was the conductor.

After the air brake had been experimented with for several months on the Steubenville accommodation, the officers of the Pennsylvania Central Railroad, having taken great interest in the experiments, and ever watchful of the safety, welfare and comforts of its patrons, arranged to have the brake applied to the Wall's accommodation, which was accordingly equipped in September of the same year, with a view of giving the brake a thorough practical test and adopting it on all of their trains should the tests prove satisfactory.

So eminently satisfactory were the subsequent trials, that shortly afterward the Pennsylvania began the application with brakes of their entire passenger equipment, being the first railroad to adopt and use the air brake as its standard.

This initiatory and progressive action of the Pennsylvania Company attracted the attention of other lines, and many inquiries were made regarding the brake and its capabilities. To practically demonstrate the value and utility of the new device, the Westinghouse Air-Brake Company, which had meanwhile been formed to manufacture air brakes, equipped an engine and passenger train of six cars with the brake, and made an exhibition tour of the principal railroad cities between Pittsburgh and Chicago. At Chicago, on the Galena division of the Chicago & Northwestern Railway, and before the most prominent and notable gathering of railway officials of the times, a successful and memorable series of tests were made. The Chicago *Evening Post* of November 26, 1869, commented upon the tests as follows:

"A large party, composed mainly of prominent railway officials, took an excursion yesterday afternoon on the Galena division of the Chicago & Northwestern Railroad, for the purpose of testing an atmospheric brake, invented by George Westinghouse, Jr., of Pittsburgh. The train, consisting of a powerful locomotive and six fine passenger cars of the Pennsylvania Railroad, was brought here at the suggestion of the superintendent of the Northwestern road, expressly to exhibit the improvement to our railway men.

"The brake, which was subjected to the most thorough tests, worked to the most perfect satisfaction of all present, who declared that its equal had not been seen. The heavy train was put under headway at the rate of 30 miles an hour, and stopped within a distance of 80 feet more than its length, in 19 seconds after the brake was applied. Another trial was even more successful, the train making nearly 40 miles an hour, and being stopped within the length of about seven cars, or some 350 feet, in 18 seconds, without jerking, the track, too, being rather slippery."

The Pennsylvania was now vigorously pushing to a finish the application of straight air brakes to all passenger equipment, cars and engines.

DANIEL P. TAIT, ENGINEER OF THE FIRST AIR-BRAKED TRAIN IN THE WORLD.

JOHNSON MOONEY, CONDUCTOR OF THE FIRST AIR-BRAKED TRAIN.

Upon the assurance of Mr. Card that Dan Tait was the engineer who really ran the first air-brake train, we immediately called upon Mr. Tait in his suburban home near Steubenville, where he related interestingly his experience with the early struggles of the first air brake as follows:

"Yes, my boy," he said, "your 'Uncle' Dan ran the first air brake. Moreover, he, along with Nick Johnson and Harry Frazer, helped Geo. Westinghouse put his first air pump on an engine. We put it on the '23,' a little eight-wheel 'Dickie' Norris engine. The air pump was one made over from an old Worthington water pump and laid flat on its back on the running board outside of my front cab window. I'll never forget—it had a leather packing in the air cylinder. After a while Mr. Westinghouse took this pump off and put on one that stood upright on the side of the boiler, and we used to take turns pushin' and pullin' at the 'trigger' valve motion to keep it going when it wanted to 'lay down.' "

"What did people think of the Westinghouse brake those days?" was asked.

"Well," replied the veteran, stroking his long, flowing beard and running his fingers through his silver-gray hair, "the brake had its friends, and its enemies, too. I think its best friends were the brakemen and myself. They liked it because it did their work for them. I liked it because it did the work quicker, surer and better than any human beings could. It gave me the control of the train, which seemed the right thing to do; for I was in the best place to see what was going on ahead, had the dose of right kind of medicine right under my thumb, and didn't have to rely on help from anybody to apply it.

"The president of the road didn't like it, for it seemed to be always getting out of order. Hanged if it didn't seem to go wrong every time he rode on the train! But there was never a trip but what it worked part of the time. When it got out of order and we had to go back to hand brakes, we would work all night but what we got it in shape for the next day's trip. I was only too glad to work on it nights, for I saw it was a 'comer,' and told Mr. Westinghouse so."

"Did Mr. Westinghouse seem to think the brake would ever amount to anything?"

"Did he? Well, I should say he did!" replied "Uncle" Dan emphatically. "He was always enthusiastic over it; never got 'stumped,' and was the quickest man to find a remedy I ever saw. 'Keep a stiff upper lip, Dan,' he would sometimes say as we wearily pulled the old 'trigger' valve or when something broke. 'There'll come a day when we get this brake in shape that no railroad can do without it.' "

"And what did you think of it, 'Uncle' Dan?"

"Why, my boy, from the very first stop I ever made with it—the stop at Fourth avenue the first trip—the stop where the Westinghouse air brake drew its first breath of life—I saw it was a wonderful thing and was bound to become a great success. After that stop I turned around to Mr. Westinghouse, who shared my seat box, and said: 'If you get this thing going all right it'll be worth millions. Mark my word!' "

"Those were prophetic words, 'Uncle' Dan."

The old patriarch sat silent and continued to stroke his silver-gray beard. His eyes wandered through the bay window of his room, where he was convalescing from a sharp illness, to the orchard trees standing forth black and bare from the heavy snow-carpeted orchard below. "Yes," he resumed, "I told Mr. Westinghouse that there would come a time when every passenger car in the country would have an air brake. He had a way of quietly smiling when I got enthusiastic over the doings of the brake, but said nothing."

Here "Uncle" Dan broke off his narrative and gave his attention to a weeping child at his knee. "Fix it, grandpa," she wailed, holding up a broken doll.

"I can't fix it, dear," he said, soothingly. "It's neck is broken square off. There, don't cry."

"Broken necks remind me," continued "Uncle" Dan, "that the air brake couldn't have been introduced on a better road; for nowhere in the land was there a pike where the engineer and fireman had to so quickly, regularly and frequently unload their baggage out the cab window, gangway or off the tender as on the Pan Handle in those days. One of the first things we learned was the soft spots along the right of way and how to strike them. About that time you were likely to see most anybody pop out on you from around a curve. I soon saw that the air brake was indispensable for the Pan Handle road and was bound to succeed."

FIRST AIR-BRAKED TRAIN ON THE PENNSYLVANIA CENTRAL.

"Did it ever save your neck, 'Uncle' Dan?"

"Indeed it did—and the necks of others, too," he replied. He sat quietly gazing into the big grate fire that threw out a hospitable warmth. He said nothing, but was evidently growing reminiscent.

"Yes," he resumed, "it did save necks —a woman's neck once, and I'll never forget the incident if I live a hundred years. One day, coming west, just as I came 'round the curve out of the cut east of Holliday's Cove, I caught sight of two women running on the track, trying to reach the station ahead of me in time to take the train. The skirt of one of the women caught on a splinter of the old iron rail, tripped her up and threw her heavily to the ground, right across the rail, not more than 150 yards ahead of me. I was running 25 miles an hour when I banged on the air, for no one can understand how horrible it is to see a human being ground to pieces under your wheels—most of all a woman. Ten men at each brake wheel couldn't have done the work the air brake did that stop. The train pulled back like she was dragging a heavy anchor from her rear end. When I stopped the pilot was one side of the narrow road crossing east of the old station, and the nearly crazed woman lay stunned and fainting at the other side. For the hundredth time I thanked heaven that we had been given a George Westinghouse to make us an air brake.

"Another time I had nearly reached the end of the long straight line on the up grade above Hanlon's, going east, when I saw several cars rounding the curve ahead, coming down. In an instant I had the air on and perceived that the cars were runaways from Dinsmore tunnel above, that was being newly arched. I reversed the "23" on sand, stopped in a surprisingly short distance, and then began to back up. I never saw a train run down hill so slow as we did. It seemed hours, and every moment those nine cars of sand and brick came rapidly closer. Finally they caught me, but I was going pretty fast then, too, back toward Hanlon's, and no damage was done. I dropped the cars into Hanlon's siding, and again thanked my lucky stars that the air brake put the train under my individual control; for had I called for hand brakes, the brakemen would have set them, then looked ahead and seen the cars coming. Then they would have jumped off and left the passengers and me to get smashed up.

"Once I had orders to meet No. 1 at Collier's. I was a little late, and came around the curve into the east end of the yard pretty lively. No. 1 was standing on the main track and hadn't opened the switch for me. Mr. Durand, the general manager, standing alongside No. 1 with other passengers, saw me coming in lively and supposed I had forgotten my orders. He ran up the track towards me, waving his hat excitedly. I stopped in regular exhibition style before reaching him, stuck my head out the window and inquired: Is there anything you want, Mr. Durand?' He stuck his hat back on his head, and says, rather sheepishly, 'No. I forgot you had the air brake.'

"The first emergency stop was made at Fourth avenue, the second trip. A coal train, with no flag out, as usual, tried to cross over ahead of me. I didn't see her until she came out from behind the high coalyard fence, and she was then not more than 40 feet away. I banged on the air, and things looked bad for all hands. The waiting passengers on the station platform scattered and ran in a panic. When the train stopped, the '23's' pilot stood off just 4 feet from the coal train. That was a fine exhibition stop.

"Well, my boy, I could spin you yarns all day about the marvelous stops and close shaves had with the first air-braked train. And you can say that during the whole time I believed, as Mr. Westinghouse did, that the brake was destined to some day become a great thing. I am the only one of the crew of that first air-braked train that is now alive. I have railroaded nearly fifty years—went firing when I was fourteen—and feel happy to know that it was I who helped this big giant—the Westinghouse air brake—draw its first infant breath more than thirty years ago."

And so the Westinghouse air brake came into life.

THE WESTINGHOUSE AIR-BRAKE COMPANY'S WORKS AT WILMERDING, PA.

Air-Brake Parasites.

The use of air pressure by the many devices operated by air pressure on the modern locomotive is enormous, and must sooner or later reach a point where the line must be drawn, or where an additional or larger air pump will become necessary. The principal parasites which thus far have come to draw their sustenance from the air-brake system on the engine are the bell-ringer, sanding device, grate-shakers, ashpan damper openers, etc.

The alarming extent of the demands of these parasites is underestimated and not appreciated. A striking illustration, however, is afforded by the experience of a prominent air-brake man who recently noticed that the air pump was working much harder than the demands of the train would seem to require. Suspecting that the parasites might be responsible for this, he had the parasites all shut off for a few moments, whereupon the 48 strokes which the pump was working per minute dropped down to 23. Upon the parasites being again cut in, the work of the pump was immediately increased to 48 strokes per minute.

Thus the parasites on the engine alone were consuming more than half the output of the air pump, leaving the remainder for the use of the air-brake system.

Highly Efficient Work of Retaining Valves.

Mr. J. M. Goodman, general air-brake inspector of the Northern Pacific, and Mr. F. B. Farmer recently made an extended series of air-brake tests on handling freight trains on the heavy mountain grades of the above named line.

One of the many valuable features brought out in the tests was the intelligent use by the engineer of the pressure-retaining valves, which were made to retain pressure in the brake cylinders far above the 15 pounds that the retainers were adjusted for. This was accomplished by frequent and numerous recharging, the holds being short. The average time between applications was 1¼ minutes, and the average reduction was 13½ pounds.

Thus the auxiliary reservoirs would be recharged, and the slide valve of the triple would close the exhaust port before the brake-cylinder pressure would have time to reduce through the small port in the retainer down to 15 pounds. By this means the retainer was made to retain almost any pressure desired by the engineer, frequently as high as 22 and 25 pounds being held. The grade had a fall of 116 feet per mile, and was 16 miles long. The speed was 18 miles per hour; did not drop below 15, and did not get above 21.

The Place is Jacksonville, Florida.

Jacksonville, Fla., has been definitely settled upon as the place where the Air-Brake Association will hold its seventh annual convention April 3, 1900.

During the fall months the yellow fever in Florida became so alarming to adjoining States that they quarantined against Florida. The cold weather, however, has so thoroughly stamped out the epidemic that the neighboring States have raised the quarantine, and persons from Florida are now allowed to pass through, as usual. All is now clear to a healthful and delightful trip to the land of flowers and orange groves.

By a vote at the Detroit convention last year, the time of meeting was changed from the second Tuesday in April to the first, which brings this year's meeting on Tuesday, April 3.

The Retaining Valve on Moving Cars.

The prevailing belief that the retaining valve is less efficient on a car in motion than on one standing still—that is, that the jarring of the car causes the weighted valve to bounce and leave its seat, has been disproven by some careful tests made on the heavy mountain grades of the Northern Pacific by Messrs. F. B. Farmer and J. M. Goodman.

These gentlemen recently conducted an exhaustive series of tests which gave them much useful and authentic data. One feature of these tests was the attachment of a gage to the brake cylinder which disclosed the fact that the weighted valve found and kept its seat better on a moving car than on one standing still. The cars tested were coal cars, and the jarring which was popularly supposed to bounce the valve off its seat, really served to aid the removal of dirt and more securely seat the valve than to hold it off.

The loss of pressure while running was found to be inconsiderable, and happened, of course, only during the period of recharge, which was short.

GENERAL OFFICES OF THE WESTINGHOUSE AIR-BRAKE COMPANY AT WILMERDING, PA.

Quick Release Valve.

The quick-release valve, which is illustrated herewith, is a device made by the American Brake Company, of St. Louis, Mo., to meet the demands of yard or switching service, where the complaint is often made that the release through the triple valve is too slow. This valve is intended to overcome this objection, and does it by releasing the brake cylinder pressure quickly and without requiring it to pass through the triple, as the device

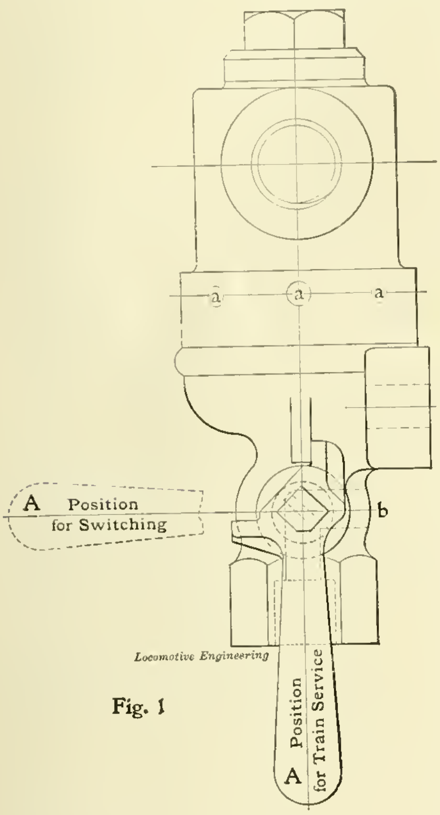


Fig. 1

QUICK-RELEASE VALVE FOR SWITCHING ENGINES.

is placed in the pipe between the brake cylinder and triple valve.

Fig. 1 is an exterior view of the valve, and somewhat resembles the pressure-retaining valve. Fig. 2 is a sectional view showing the operation of the valve. When the handle *A* is turned down, as in Fig. 2, the device is inoperative; that is, the pressure that is released from the brake cylinder passes through the valve, entering at *X* and passing out at *Y*, thence through the exhaust cavity of the slide valve in the triple as usual, out of the exhaust port, into the device at *Z*, and finally to the atmosphere through port *b* with the same freedom as though the device were not there.

To get the air quickly out of the brake cylinder, the handle is turned up as per the dotted lines in Fig. 1 to "Position for switching." The instant the triple piston goes to release position the brake-cylinder air takes the same course as above described, but finding port *b* closed, passes on up through port *e*, strikes the under face of large piston *B*, which in turn moves upward, unseating valve *C*. Then the brake-cylinder pressure quickly escapes through ports *a*, *a*, *a*.

Though the device is not very generally used, still it has given satisfactory results wherever its presence has been required.

Will the Gage Tell?

The following is in reply to the communication from a correspondent who asks if it is possible for an engineer to distinguish by the action of his air gage the difference between an emergency application caused by a broken graduating pin or a sticky triple.

It is safe to say that the engineer cannot tell by the action of his gage hand alone whether an emergency application on his train is due to a broken graduating pin, broken or weak graduating spring or a sticky triple valve piston. There are other things, however, which, if understood and carefully observed in connection with the action of the gage pointer, will indicate which of these causes gives the undue emergency action.

A broken graduating spring in a long train will not manifest itself by causing a quick-action application if brakes be applied in service position; but if, in a very short train, a long continuous service application be made, the triple valve will probably go into quick action. It is possible, too, on a short train to apply the brake valve in service application without getting quick action. This may be done by making very light and inconsiderable reductions in the train-pipe pressure until about 20 pounds has been drawn out.

A broken graduating pin is not responsible for quick action as often as it is blamed; but sometimes in service application, causes its triple to go into quick action and to thereby throw the rest of the train in also. This is particularly true where both the piston travel and the train are short; but where they are long, quick action very seldom follows. Nor can it then throw the other cars into quick action. A broken graduating pin, of course, will not allow the graduating port through the slide valve to open and let air from the auxiliary reservoir into the brake cylinder. Consequently, a brake application will not be had until the triple valve piston travels nearly its full stroke, compressing the graduating spring. If, at the instant the slide valve gives an opening from the auxiliary reservoir into the cylinder, the movement of the triple valve piston and slide valve is very smooth and gradual, and not jerky, the brake will probably apply in service application and not in quick action. This would be true on longer trains particularly, but not on short ones. It will be understood from this, of course, that it is even possible, under the above conditions, to apply the brake in service application, even though the graduating pin be broken.

A sticky triple valve which applies the brake unduly in quick action usually does so once only, and then behaves very well. That is, after it is once jerked loose, it will apply in a service application almost as well as though it had never been stuck, unless, of course, the slide valve is entirely without oil and is in a sticky and gummy condition. These are the things that must be known and understood before an engineer can ever approximate by his gage, which one of these three irregularities it is which gives quick action. Even then it must not be forgotten that the black pointer on the gage indicates the pressure in the chamber D above the equalizing piston of the brake valve, and not the train-pipe pressure except as the two communicate by leakage past the packing ring of the equalizing piston; and that, after all, the gage hand has very little to do with locating the trouble.

These can be summed up as follows: A broken graduating spring, when causing quick action, will do it during a continuous service reduction and may be either early or late during the reduction. A broken graduating pin will not cause quick action until late in the total reduction, whether that reduction be made in several small installments or one full reduction, unless the piston travel be very short. A sticky triple valve will hold back until

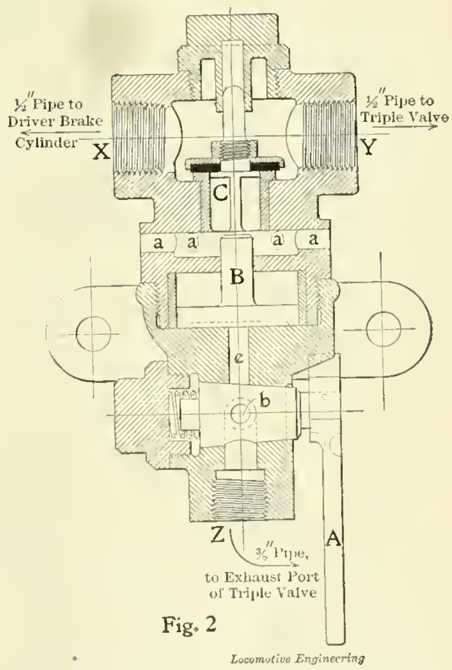


Fig. 2

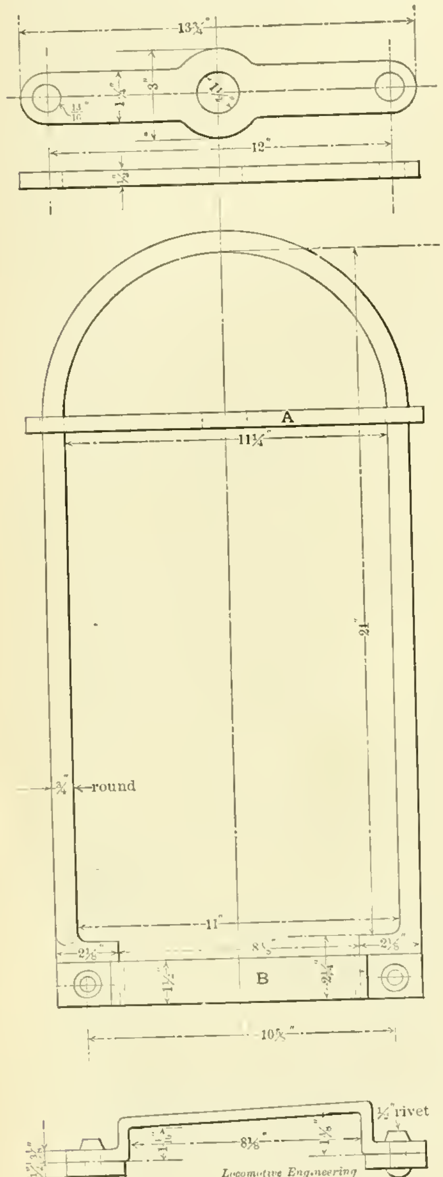
QUICK RELEASE VALVE FOR SWITCH ENGINES.

broken loose. This breaking loose depends on the degree with which the piston sticks to its cylinder, which may require only 1 or 2 pounds to jerk it loose, or may require 10 or 15. But by watching the gage alone a man cannot tell which of these three irregularities causes the undue quick-action application. One is easily mistaken for the other, and under certain conditions one defective part may do just what another was expected to, and *vice versa*.

Sling for Lifting Air Pumps.

Editor:

The enclosed drawing shows a sling for 8-inch air pumps which has been in use in the Vandalia roundhouse for over



SLING FOR HOISTING AIR PUMPS.

two years. A larger sling of similar design is used for the 9½-inch pumps.

The piece *A* is drilled as shown and slipped on before the feet are welded on. To take hold of a pump, the feet are placed under top flange of center casting. The cross-brace *B* coming against center casting prevents sling from slipping backward, and the feet coming behind the bolts at sides of center casting prevent it from slipping forward. Piece *A* is slipped down on reversing valve chamber cap, the sling is caught by a hook above *A*, and pump is raised or lowered by a suitable hoist. In the plan view only the feet and cross-brace *B* are shown.

W. P. Hawkins,
Vandalia Shops.

Terre Haute, Ind.

Four Thousand Pound Driver Brakes.

Editor:

On page 53 of your January journal you say it is wretched engineering to build driver brakes that weigh 4,000 pounds. Maybe it is, and maybe it isn't. You have got to make brakes strong enough to hold the engine. A heavy engine must have a heavy brake. Some of the battleships, called engines to-day, pull any train that is loose at both ends, and you have to use a spyglass to see the caboose. These royal hogs must have strong driver brakes to hold them. You can't do it with broom straws or cobwebs.

Iron is so expensive nowadays that ladies will soon be wearing iron jewelry if it keeps up. No brake company is going to squander iron in driver brakes. The American Brake Company has made liberal use of iron in making good, strong brakes. If they hadn't, their outside equalized brake would not be the standard of the country to-day. But they are not such poor engineers to pile on a big heap of iron just to see it hang. None of the brakes on the Chattanooga roads weighs anywhere near 4,000 pounds. If there are any anywhere I'll bet there's a good reason for it.

To put a brake on some of these engines they build to-day must be a job. I don't see how they do it, unless they call in some of these show brothers that pull rabbits out of your ears or a bowl of goldfish out of your vest pocket.

Otto Best,
A.-B. Insp., N. C. & St. L. Ry.

Nashville, Tenn.

Two Applications for Service Braking.

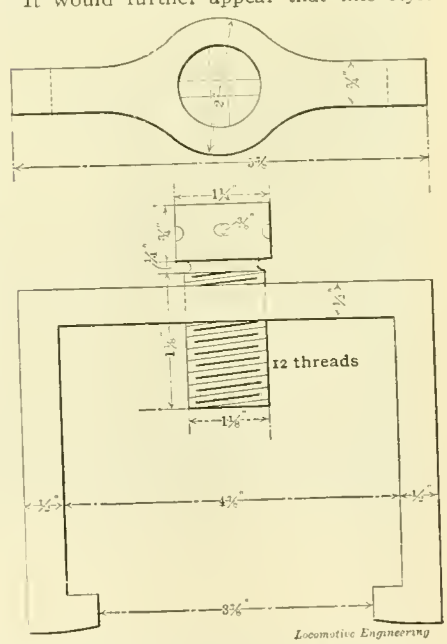
Editor:

Results show that there is more wheel-sliding in stopping at stations than in down-grade running from the use of the air brake. This would appear to be due to the fact that not only does the engineer, when on the grade, refrain from using too much of his air power, holding an amount in reserve for safety, but that when making a station stop, he endeavors, if possible, to stop on one application which handling of brake is generally believed to reach nearly to perfection. If, therefore, he is engaged in fast passenger service this practice can only be successfully followed by applying the brakes lightly at first and gradually adding to the brake-cylinder force as the stopping point becomes nearer, when the distance and speed can be more accurately compared. The pressure recorder almost invariably shows that the final stop is only accomplished at the required point by an application of all the remaining air power at his command. The increasing power, together with the slower speed, creates sufficient shoe friction, particularly on the well-braked cars, to cause not a little wheel-sliding.

For some time past the practice of making two applications has been encouraged in preference to one, particularly on fast passenger trains, and when the brake is first applied a heavy reduction of train-pipe pressure not exceeding 10 pounds should be made. This has the effect of causing the train to lose speed more rapidly than by a lighter application, and the speed being high, there is no danger of sliding wheels, and the train thus tending to stop somewhat short of the required point, will enable the engineer to release and make the final stop on a second and even lighter application. By this practice we conform more to the condition provided for in the Westinghouse air brake high-speed brake (emergency feature), viz., of decreasing the pressure as speed decreases.

The former method is just the reverse, as the pressure is systematically increased as the speed decreases, sometimes finishing with 50 pounds pressure in the cylinder at the slowest speed. With the latter plan and a little judgment the maximum cylinder pressure should not exceed 25 pounds in cylinder, and this amount applied at the first when speed is high is more effective in stopping train in a shorter distance than double the pressure reached only at the slow speed by gradual increase. Thus the train reaching the slow speed with only 25 pounds pressure in cylinder will have have as great a tendency to wheel-sliding as with 50 pounds.

It would further appear that this style



DEVICE FOR SEPARATING VALVE CAP FROM BRAKE VALVE BODY, SUPPLIED BY MR. B. HARDY.

of service stopping provides a wider margin of reserve power for quicker stopping should occasion require. This style will largely reduce wheel-sliding at stations.

C. R. Ord,
A. B. Insp., C. P. R.

Toronto, Canada.

[Mr. Ord's communication was received just a little too late to appear in January number.—Ed.]

Locating Brake Valve Leakage of Main Reservoir Pressure Into Train Pipe.

Editor:

The different methods recommended by air-brake authorities of testing for leakage from main reservoir to train line through the F-6 brake valve are confusing to most men, especially such elaborate preparations as are necessary in following instructions for testing for leaky rotary valves, by drawing all the train line air out in service application position and then immersing tender hose in a bucket of water to look for bubbles, as given, and which would reveal no leakage if it existed. Directions must be followed literally, and when a complete service reduction is made the equalizing discharge piston will rise and valve remain open until the handle is moved back to release position. Thus, with the train line exhaust open, any leakage from under the rotary valve would pass to the atmosphere there, rather than force its way through the water in which the hose coupling is immersed.

A test by closing the cut-out cock in the train line connection to brake valve is not a fair test. With such a contracted train line almost any brake valve will, in running position, allow the black pointer to slowly rise to equalization with the red one. In practice we never have a shorter train line than that of the engine and tender; and if with that length of train pipe, the valve in running position, the gage shows excess pressure is being maintained, don't test for internal brake valve leakings; but if the feed valve is correctly adjusted, and handle in running position, the black pointer moves up to main reservoir pressure, I instruct to make a service reduction—say 10 pounds—lap the valve and note results.

(a) If there is a continuous discharge from the preliminary exhaust port while the valve is in the service position, yet the black hand remains fixed at main reservoir pressure, there is a leak past the leather gasket of main reservoir air to chamber D. The area of leakage is as great as the area of the preliminary exhaust port.

(b) Preliminary exhaust is clear and black pointer indicates the reduction. By lapping the valve the black hand rises to the red one, but brakes hold applied. The leak is at the same place as noted in (a), but the area of breakage is less than the area of preliminary exhaust port.

(c) Black pointer indicates the reduction from chamber D and brakes apply. Lap the valve and black hand stands still. Brakes hold applied. The leak was through the feed-valve attachment.

(d) Black pointer falls as pressure in chamber D is reduced; but on lapping the valve it again rises and brakes release. Leaky rotary valve. When the latter test has proven a leaky rotary valve, continue as follows:

(e) Recharge in running position. Cut out driver and tender brakes and make a 30-pound reduction. Lap the valve and time the rising of the black hand. After it has shown an increase of about 15 pounds, move the brake valve handle over the shoulder into running position. If the black hand moves up faster than before it indicates that the feed valve and rotary valve both leak.

There are several defects that may be in the feed valve, any one of which will cause the leak from main reservoir to train line—but "that's another story."

W. W. Wood.

Air Brake Instructor, Monon Route.
La Fayette, Ind.

Fitting Packing Rings in Triple Valve Pistons.

Editor:

The subject of fitting packing rings to triple bushings is very interesting to me, and I would like to comment on it through your columns.

I will admit it is a very particular job to make a perfect fit of a packing ring in the bushing of a triple valve. It takes time to fit it perfectly. But I will say that I can fit packing rings to triple valves that will set and release brakes on long trains and will stand as good a test as those sent to the manufacturers for repairs. I do not bore a bad, worn bushing, but use a device of my own to true up the bushing. It is nothing more than a lapping machine. The laps are made of lead and run at a fast speed. I use Trojan grinding compound to grind out the bushing. It will make the hole round and true. Then file the ends of the piston rings so they overlap a trifle when in bushing; then fit to groove in piston. Then I fasten it to the ring-fitting machine (which was illustrated in November issue), and use oil to grind the ring to fit the bushing. In this way I get a perfect fit. I can fit up triples, except renewing bushings, for one-third less than it costs to send them to the works and have it done. J. N. Makley,

Repairman, St. L. & S. F. R. R.
Springfield, Mo.

[It would seem the better plan to return the triple valve to the manufacturer when packing rings are needed; for a triple which has done work until it needs a new packing ring, will need other repairs also. The bushings should be pressed out and such parts replaced that will standardize the valve. Thus a new triple is virtually had for the cost of repairing an old one. It is reasonable also to suppose that specially designed and greater facilities will do better and more uniform work. With the number of air brakes now in use, it would be about impossible for a railway to properly overhaul and repair all of its triple valves. A number of the railroads see this, and are returning the triples to the manufacturer for repairs.—Ed.]

Some Good Observations and Suggestions.

Editor:

If you will notice while on the road, and if you should take a trip through a terminal yard just before the departure of a train, you cannot help but hear the number of leaks which exist in the train pipe and its connections. And if the air pump is not up to its proper efficiency it will have a hard time in maintaining the necessary amount of air.

The trainmen, as a rule, are willing to tighten up all loose unions, so they can have more cars of air coupled up and working. The ones to give the most trouble are the train pipe union next to drain cup and the union next to the triple valve and hose coupling gaskets.

The triple valve gaskets are often leaking, and especially on triple valves which have been lately cleaned in which the workmen were careless in tightening up the nuts after cleaning the triples. I have seen as many as five cars in one train which were leaking at triple valve gaskets on account of bolts not being properly tightened up. And why is it that so many cars are cut out? Do not most of the cars cut out leak at pressure retainer on account of defective emergency valve seats? I noticed one day in a train of fifteen air-brake cars seven were cut out.

I was walking through a yard one day and came upon a man busy at work cleaning triples and brake cylinders, and this is the way he did his work: He just took the triple valve all to pieces and threw the parts down on the ground. He then went to work on the brake cylinder and piston and cleaned them. Before putting the piston back into the cylinder he poured in about a pint of engine oil, then put the piston and cylinder head into place again. He then went to work on the triple valve, wiping off the different parts, and finished up by giving all a good dose of engine oil and marking brakes "O. K.," which they were, after a fashion.

Now, would it not be a good plan to either supply all engines or cabooses with open wrenches for drain cup union and triple valve union, instead of having to use a monkey wrench, or more often a hammer and cold chisel? And would it not be a good plan to supply each caboose with a few hose coupling gaskets, instead of having to use train orders to make a tight coupling, and allowing the paper to work back into strainers and stopping them up? These defects do not exist to a very great extent on a road which maintains its brakes in the proper condition.

Sioux City, Ia. C. F. Sundberg.

All trace of the yellow fever in Florida has disappeared, the quarantine has been raised and nothing remains to impede a successful meeting and a healthful and delightful trip to the land of flowers and orange groves. Let the slogan be: Ho! for Jacksonville, Fla., April 3, 1900!

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(8) J. C., Kamloops, B. C., writes:

On page 77 of his book, Mr. Blackall has a table showing different pressures. The fifth and sixth lines do not seem to work right. If he would change the 100 in the fifth line to 110, I think it will then work better. A.—This is a printer's error and will be corrected in the next edition. The 100 will be made to read 110.

(9) J. H. R., Omaha, Neb., writes:

Will you please answer the following question to decide an argument? Can an engineer tell by the action of the gage whether it is a broken graduating spring, a broken graduating pin or a sticky triple piston that causes the brakes to go into emergency? Some say the black hand on gage will jump when it is a sticky triple. I say no. A.—See lengthy discussion on this question under head of "Will the Gage Tell?" elsewhere in this department.

(10) A. B. L., Philadelphia, Pa., asks:

What is the "thermal test" spoken of in the Air-Brake Association Proceedings for 1899? A.—This is a test employed at the foot of mountain grades or elsewhere when poor holding brakes are being searched out. A good holding brake will heat up the wheel-tread. A poor one will not, or will only heat in proportion to the work it is doing. Therefore, by placing the hand on the wheel treads right after hard work has been done by the brake, the poor brakes, which perhaps had passed other tests and escaped, will be detected in the "thermal test."

(11) J. M. S., Texarkana, Tex., asks:

What would be the effect on a driver-brake triple if the graduating spring was broken, stuck down or removed entirely—first, with light engine; second, with train; light reductions in both instances? A.—If the train-pipe reduction were light enough and continuous, an absent or broken graduating spring would make no difference, providing the triple valve was otherwise in good condition. A service application only would be had either on a light engine or one with a train. If the triple were dirty or the equalizing piston in the brake valve not sensitive, an emergency application might be had, particularly if the engine were light or had only one car.

(12) J. G. R., Weatherly, Pa., writes:

I want to know why the air pump governor is piped to the train line with the D-8 brake valve and to the main reservoir on the F-6. A.—In both cases the object is to govern or regulate the pressure in the train-pipe and auxiliary reservoirs. With the D-8 valve the governor controls the train-pipe pressure directly, and the excess pressure valve permits 20 pounds more in the main reservoir, thus making the main reservoir and train-line pressures 90 and 70 pounds, respectively. With the F-6 valve, the feed-valve attachment controls the train pipe and auxilary reservoir pressure, and shuts off when 70 pounds is accumulated therein. The pump governor, then, has only to regulate the main reservoir pressure.

(13) L. L. L., Pinckard, Ala., writes:

In "Air-Brake Diseases," by Paul Synnestvedt, there are illustrations of different valves beneath which appear the words Westinghouse, year and catalogue number. Now, what I wish are plates of Westinghouse 8-inch pump, 9½-inch pump, D-8 valve and F-6 valve and governor, with all parts numbered and named. Can you tell me where such charts can be obtained and the price? A.—The names and numbers describe the parts as they appear in the catalogue, which is sent out to storekeepers and others who have to do with ordering air brakes. The same illustrations with the descriptions, but the lettering a little different, appear in the Westinghouse instruction book, which may be had by applying to your master mechanic, who can get a sufficient number for his men, free of cost.

(14) E. H. C., Boston, Mass., writes:

A asks B why it was that the port in a 9½-inch pump for the down stroke opened only half of the port, but on the up stroke the port was wide open. A claimed the cause was on the up stroke; the port opened wide because the weight of the piston, of both heads and rod, was dead weight; consequently it required a larger port opening than on the down stroke. It did not require as much steam for the down stroke, as the weight of the piston helped it down. B says it is a mistake. Who is right? A.—The valve ports have the same opening for the up stroke and for the down stroke. It is a mistaken impression that one port opens only half way. It is true, however, that the up stroke has the harder work to do to the extent of lifting the weight of the piston, besides having a little less piston area (the piston rod) to do it with; but taking it altogether, the advantage the down stroke has over the up stroke is scarcely 3 per cent.—not enough to make allowance for, let alone giving one a full port opening and the other only a half.

(15) J. C., Kamloops, B. C., writes:

Mr. Blackall in his Air-Brake Catechism says, in answer to the first question on page 71, that with retaining valves working, if you make a full application, the long piston travel will have the most power. I consider this an error, and it is so proven by the figures in the table on page 72. Please explain. A.—You have misinterpreted the question, as most any reader would be likely to do at first reading. Mr. Blackall does not mean a gain in braking power, but means a gain in second application over the first. For example: Full service at 6 inches travel gives 53 pounds. Turn up retainer, release brake and set full again with 15 pounds retained in cylinder. This will give 58 pounds, a gain of 5 pounds. Do this same thing on a 10-inch travel. A full service will give 46 pounds. Full service with retainer gives 54 pounds, a gain of 8 pounds, which is 3 pounds more than the gain in the 6-inch travel. Of course the short travel gives greater braking power, but that was not the point Mr. Blackall wished to bring out, as has been explained.

(16) S. C. C., Hartford, Conn., asks:

What is the capacity and efficiency of the 9½-inch Westinghouse pump over the 8-inch pump, and how is it worked out? A.—Making a liberal allowance for losses through heating of the air, that slipping past packing rings and that due to clearance, it will be found that the approximate volume of atmospheric or free air received per stroke with the 9½-inch pump, in pumping from zero to 90 pounds, at about 100 strokes per minute, is about 33 cubic feet. That is, the intake of the air cylinder, or the amount of free air passing through it in one minute, at 100 single strokes, is 33 cubic feet. A similar calculation gives the 8-inch pump, at 110 strokes per minute, a capacity of about 20 cubic feet. Thus the 8-inch pump has only about two-thirds the capacity of the 9½. Owing to the improved valve motion of the 9½-inch pump, the efficiency is higher than the 8-inch pump. The efficiency of the pumps is gotten by dividing the volume of steam used into the amount of air pressure obtained. Example: 42,000 inch-pounds of steam have been required to compress 20,000 inch-pounds of air. The efficiency of that pump would therefore be about 47 per cent.

(17) H. J. S., Chadron, Neb., writes:

What is wrong with the D-8 brake valve that will work all O. K. on a short train line and will not work on a long one? That is, it will work well on a passenger train of six or seven cars, but will not work on a long train of twenty or twenty-five cars. When you make a reduction of 10 pounds, piston 17 or the equalizing piston will not seat. There are no leaks in chamber D or any of its connections. This valve works alike on all engines. A.—We will assume that all connections are tight and that the reduction made is not sufficient to allow the emergency check valves to leak brake-cylinder pressure back into the train pipe. The trouble then must lie in the equalizing piston, its cylinder, or both. It is most probable, however, that the packing ring allows a certain leakage past it, so that on a long train there might be reached a stage in the application (should the packing ring be sufficiently stiff) where air would pass from chamber D, past the ring, into the train pipe and out through the train-pipe discharge. This would happen if the ring or its cylinder were badly worn, or if the ring had been newly and improperly fitted; and would take place on long trains, but not on short ones.

The Increasing Weight of Engines.

The following letter from the Brooks Locomotive Works is decidedly interesting, as it shows the increasing weight of engines over former years and the effect on the number turned out by any plant:

In summarizing our output for 1899 and comparing it with that of former years, we find it presents some interesting features, particularly as showing the marked tendency on the part of railroad companies for heavier locomotives. This is amply demonstrated by a comparison with our output for 1891, our best previous year, as regards number of engines completed.

Statement of Brooks Locomotive Works, showing engine output for years 1891 and 1899:

Engines completed—1891, 226; 1899, 300.

Total weight engines and tenders in working order—1891, 41,726,350 pounds, 20,863 N. T.; 1899, 81,123,600 pounds, 40,562 N. T.; increase 94½ per cent., about 20,000 N. T.

Average weight of each—1891, 184,629 pounds; 1899, 270,412 pounds; average increase, 85,783 pounds per engine.

Total weight of engines only, in working order—1891, 25,455,100 pounds, 12,728 N. T.; 1899, 49,730,400 pounds, 24,865 N. T.; increase 95⅓ per cent., about 12,000 N. T.

Average weight of each—1891, 112,633 pounds; 1899, 165,768 pounds; average increase 53,135 pounds per engine.

Total weight engines and tenders empty, showing actual weight material produced—1891, 29,778,410 pounds, 14,889 N. T.; 1899, 57,681,300 pounds, 28,841 N. T.; increase 93¾ per cent., about 14,000 N. T.

Basing the output of engines and tenders in working order fo 1899, at the average weight produced in 1891 would equal 439 complete locomotives.

The lightest locomotive built during the year was a mogul engine and tender weighing, in working order, 97,014 pounds; the heaviest, a twelve-wheeled engine and tender weighing, in order, 364,900 pounds. The latter has 23 x 30-inch cylinders and is the largest locomotive in the world.

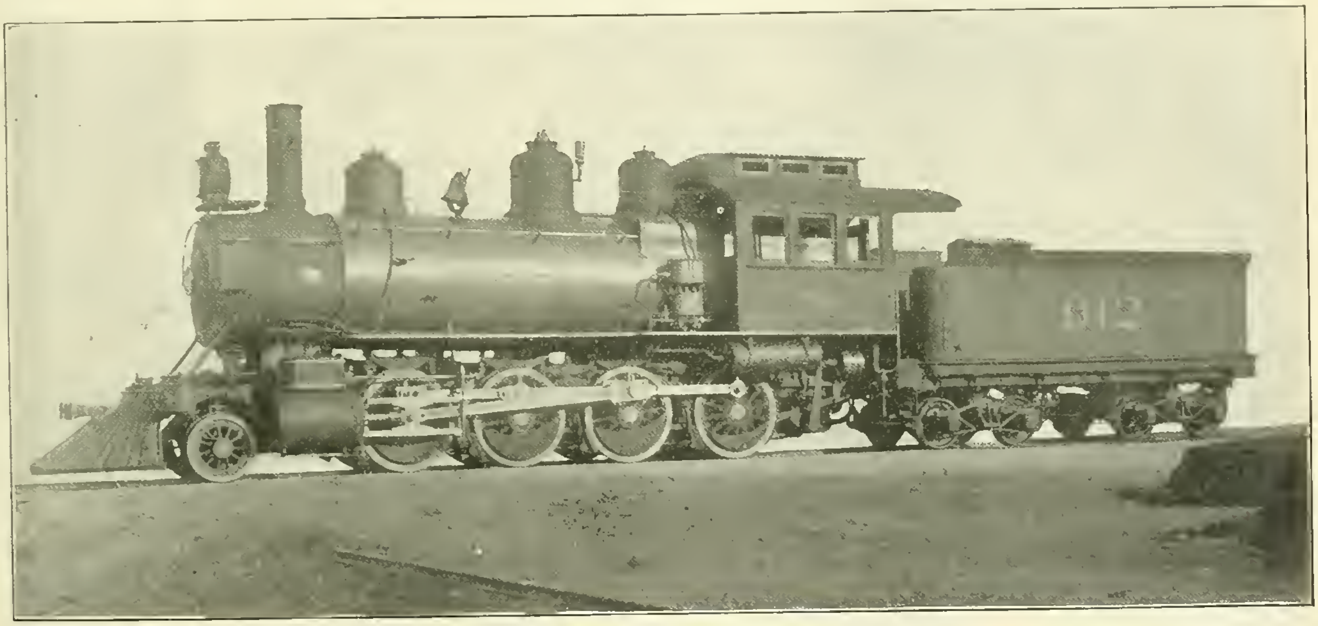
Very truly yours.

Brooks Locomotive Works,
By T. M. Hequembourg, Secy.

Cooke Consolidation for Louisville & Nashville.

The annexed illustration shows a consolidation engine which was one of five recently built by the Cooke Locomotive and Machine Company, of Paterson, N. J., for the Louisville & Nashville Railroad.

The engine has cylinders 21 x 26 inches, has a total weight of 156,000 pounds, of which 139,000 are on the driving wheels. The driving wheels are 52 inches in diameter, four of them are cast steel and four cast iron. The total wheel base is 23 feet 8 inches, 15 feet 11 inches being the driving wheel base. The driving axle journals are 8½ x 10 inches, and the engine truck axle journals 5½ x 10 inches.



COOKE CONSOLIDATION FOR LOUISVILLE & NASHVILLE.

The boiler is of the Belpaire style, which has long been a favorite with the Louisville & Nashville, and carries a working pressure of 175 pounds. The boiler is 66 inches in diameter at the first course, and the shell is ⅝ inch thick.

The firebox is 122⅝ inches long and 33⅜ inches wide. There are 224 2¼-inch tubes 14 feet long. The heating surface of the tubes is 1,834 square feet and in the firebox 188 square feet, making a total of 2,022 square feet. The center of the boiler is 8 feet above the rail, and the top of the stack 15 feet 3½ inches above the rail.

Among the special equipment mentioned are Latrobe tires, Monitor injectors, Ashcroft steam gages, sectional magnesia boiler lagging, Coale safety valves and United States metallic packing.

"The Proposed Pacific Cable" is the title of an interesting paper by Mr. Harrington Emerson which appeared in the *Engineering Magazine* for last November. It has been reprinted, and can probably be obtained from Mr. John R. Dunlap, editor of the magazine. It is not only interesting in a general way, but at this time it is of vital importance, when the question of communicating with our new possessions is considered. Mr. Emerson shows four routes, the shortest being a practically straight line which leaves the continent at Cape Flattery, passes through the Aleutian Islands, Behring Sea, Yokahama and Manila.

At the St. Louis convention of the Brotherhood of Locomotive Engineers, instructions were given to the executive committee of the brotherhood to select a site for the erection of a building to form the headquarters of the order. This committee have visited Cleveland, and will report to the next convention, to be held in Milwaukee the second Wednesday in May. The committee propose to recommend the purchasing of a site and the erection of a building in that city. It will remain for the delegates at the next convention to determine what they will do with the report of that committee, and until the question has been disposed of by the convention no further steps will be taken in the matter.

In describing the Australian consolidations on page 463 of the October issue, the tank capacity was given as 3,000 gallons. Our informant wishes to correct those figures, as they are in error. The correct capacity is 4,500 gallons—quite an increase.

Schenectady Locomotive Works New Drawing Office.

We mentioned the splendid distribution of light in the new drawing room of the Schenectady Locomotive Works in a recent issue, and are glad to show a photograph of it with this, through the courtesy of the *American Machinist*. The photograph proves the even distribution of light more effectively than can be done in any other way. It is the best drawing room that we have seen in this respect, and the method of lighting deserves to be considered with care.

INTERIOR VIEW OF THE SCHENECTADY LOCOMOTIVE WORKS DRAWING OFFICE.

A curious system of tunnel lighting, and incidentally car lighting, is about to be introduced in an underground railway in Paris. Electric lamps of 10 candle-power are to be set in the walls of the tunnel just at the height of the car windows and only one metre (39 inches) apart. The entrance of a train into the tunnel will turn on the lights, and the passing of the rear car will break the circuit and turn off the lights. It seems to us that this system might be used to advantage in all our long tunnels.

The Wreck at Baree.

BY HENRY A. FERGUSSON.

I was a member of the wreck crew at last, and so pleased over it that I gave all the men in our gang, except the boss, a two-for-five cigar to smoke at dinner hour.

It was a proud distinction for me. Only three years before I had appeared at the foreman's office without a cent or a friend, begging a job in the car repair shop, and he put me in the worst gang in the shop, at fifteen cents an hour pay. I say the worst gang, because they had the meanest man for a gang boss, and did all the stock car repairs.

Tom Fletcher, the boss, was the queerest mixture of hypocrisy and misguided religion I ever met. He would dock a man an hour's pay for a couple of minutes spent during working hours in putting a few sticks of kindling wood into his dinner bucket, and then ask him solemnly if he "could ask the Lord to bless it," while his own big dinner basket, perhaps, carried out enough nails to build a barn. It was through no agency of his that I was promoted to the wreck crew, but it came about in this way:

My boarding house was near the big car shop yards, and late one night there was a wreck down the road, and the caller started out to gather in the crew.

When he banged on the side of the house with a club I awoke and bounded to the window, raised it, and wanted to know what was the trouble.

"Tell Ike Rhodes the wreck crew starts in twenty minutes," he shouted, and was off.

Now Ike boarded in the same house with me and we were pretty good friends; but, unfortunately, he had gone to a secret labor meeting in a neighboring town and wouldn't be back until morning. This meant a week's suspension for not reporting, and I resolved instantly to take his place. Slipping into my clothes, I left the house and made a straight line for the wreck train. Old John Strong, foreman and wreck boss, sized me up the moment I came in sight.

"Where's Rhodes, and what are you doing here?" he asked in one breath.

"Ike's sick," lied I; "and I came in his place, if you need me."

"All right. Git into the tool car," said he, and a moment later waved a signal to the engineer, and off we started.

There were sixty men of us, all told, aboard, most of whom I knew in the shop; and not caring to have any more questions asked me about Ike's illness, I went into the block car and sat down on a coil of rope.

I had not been seated long before the "Old Man" came through, and I anticipated any embarrassing question about Ike by asking him where the wreck was.

"Down at Baree," he replied; "head on collision," and he went on through to the engine.

I got up presently and opened the side door as the train began to slow down. It was just dawn of a clear morning, and on looking out I saw the wreck a few hundred yards ahead of us. It was a great sight. There were cars piled up forty feet in the air, looking in the twilight like some huge animal, the staring eyes of two wrecked, but unquenched, headlights heightening the effect.

Not many minutes had we to think though. "Out with you," bawled the Old Man. "Bring up four log-chains and two lengths of three-inch rope."

Ike Rhodes belonged to the gang which handled the ropes, so I fell in with them as they came into the block car, and helped to get the heavy coils out through the door and dragged along the track.

While the men were busy making these preparations, the Old Man was making an inspection of the wreck, like a general before a battle.

The wreck had occurred at a place where there were three tracks, the middle one being used as a siding, and about five miles long. At each end of this siding, where it turned out into the two main line tracks, was a signal tower governing the crossings and switch levers controlling their use.

West-bound, about 2.30 A. M., came a fast merchandise freight, designated as "Extra No. 865," two engines ahead and forty cars trailing behind like some giant anaconda, with eyes along its sides, where the white lamps of the brakemen shone.

Clickety, click click; clickety, click click; clickety, click click, came the operator's call from the train dispatcher's office. It was unheeded, for the operator was sound asleep.

The switch was set for the siding, and along came our anaconda and poked its big double head in on the middle track.

The noise of the passing train woke the operator, and he mechanically reached out and answered the dispatcher's call.

"Run Extra No. 865 main line to Baree tower," came the order, followed quickly by: "Why didn't you answer?"

He couldn't give a satisfactory answer to this, so simply said "O. K.," and closed the key. Cold drops of perspiration stood out on his face, for already the red lights on the caboose of Extra No. 865 were disappearing around the curve in the distance. He had one resource left. Calling up Baree tower, he told the operator there, "Extra No. 865 is on middle track, west bound; let nothing in;" back came the heart-breaking reply: "Extra No. 1167, thirty loaded coal, east bound, passed in on middle siding five minutes ago."

It was an agonizing moment, and the poor fellow, mentally upset, from mere force of habit set the signal for the main line red, and then ran away into the night, pursued by the horrible thought of what would surely happen through his neglect.

The two trains rapidly approached, and on rounding a bend came in sight of each other. Down brakes was screeched from three whistles simultaneously, and throttles were instantly closed; but nothing human could have stopped them, and each engineer, having done all that he could, jumped.

The opposing engines met with a crash like artillery, reared for an instant, and fell off at each side, shattered to pieces. The second engine of the west-bound train climbed the wreck of the other two and stood there like a monument, while car after car rose and turned, crashed, smashed, and fell, scattering its contents on the debris, until, momentum being spent, all was still but the violent roar of escaping steam from the ruptured engine boilers.

Not one of the train crew was killed, for, being warned in time, they had all jumped.

The Old Man completed his survey of the disaster and immediately began to act on his rapidly formed plans.

Mr. Morrison, a lately promoted trainmaster, had arrived at the scene, and was acting with the usual dignity of a beheaded fowl about it. Old Man Strong was pretty cool and kept every man of us busy. There was an old orchard full of gnarled and rotten apple trees on the opposite side of the road from the damaged house, and it was exactly what the Old Man needed.

I was sent in there, with McGuire and a couple of other men, to lash a sheave-block to one of those trees, the rest of the men being variously employed in throwing broken pianos, sewing machines, damaged crates of shoes, hats and all sorts of merchandise, together with tons of coal, off the tracks, and in securing the ropes to broken car bodies and trucks for the engine to drag down over the bank.

It resembled a gigantic game of jack-straws, in which a point is won when something moves. Presently something moved near me that wasn't expected. Our old apple tree, weary with its weight of years plus the strain of dragging a thirty-ton capacity coal car from the embrace of several others, broke off with a crackling thud. We lost no time in getting our block to another tree, which also broke off, and we were proceeding to the next one, when Mr. Morrison, the trainmaster, called down to us to stop.

We then saw that he was having a violent conversation with an old farmer, evidently, from the way he was pointing and gesticulating, the owner of the orchard, and who was protesting against the destruction of his trees.

His words must have been effective, for Mr. Morrison ordered us to stop, take our tackle around to the other side and fasten it to something there.

Now, if there is one breach of railroad etiquette more disagreeable than any other it is for an officer, however exalted his position, to interfere with the wreck master while he is clearing up a wreck; for it is only practicable to work out one plan, and the wreck boss himself generally knows which is the quickest way to clear the tracks, and will not stand much interference.

Our new trainmaster was totally unacquainted with Old Man Strong's disposition, or he would not have ordered us anywhere.

The Old Man saw us as we came around the pile.

"What are you fellows doing here?" he thundered.

"Shure, Mr. Morrison was afeard we wud spile the apples, an' tould us to come here," said McGuire.

This set the Old Man to boiling, and he ordered us back to our work at once, striding ahead himself.

As we went down over the bank he began to talk to the trainmaster. "Morrison, there is only one way to clear this track quickly, and I have to use that orchard, if I rip up every tree in it."

"Now, Mr. Strong," replied Morrison, "it seems to me that we might save those trees by working from the other side."

"How about that engine?" said Strong, pointing to the one standing almost straight in the air. "You can't get that across to the other side short of two hours, and more than that," his voice like a bull. "I am taking up this wreck, and will be glad not to have you order the men around."

Morrison grew white to the lips, and without a word started for the box relay to send a message to the superintendent about it. I heard afterwards that he got an answer back to "let Old Man Strong alone," but, however that may be, he gave the wreck crew no more orders.

We went ahead in the orchard, and the way things began to rip and tear out of that pile of cars beat anything I ever saw.

One track was soon cleared of all except the engine and tank of the east-bound train, which lay across the rails and supported the one which was standing up.

The Old Man was going to try and pull that standing engine over from the orchard in the same way as he did the cars; so we were ordered to lash the block to three more trees and run a heavier rope through. When all was ready the engine doing the pulling took up plenty of slack and went back with a jerk.

The wrecked engine moved about a foot and all three apple trees snapped off, making nine that we had destroyed, and leaving no more of sufficient size in the orchard.

But still that engine stood up and seemed to defy us.

The derrick was run forward, and, powerful though it was, could not budge it.

I had been set at shoveling coal down the bank as a sort of relaxation from the orchard episode, when a brilliant idea occurred to me. Whether it was the result of the shoveling or not I can't say, but it promised relief for a few minutes, and I determined to tell the Old Man about it.

He was yelling at the derrick gang when I got to him, but, nothing daunted, I spoke up.

"Excuse me, Mr. Strong," I began.

"Well, what do you want?" he said, sharply.

"I thought that if you had an engine on the other side of the wreck you could easily slide that one standing up out backwards."

"True enough," he replied, somewhat less roughly; "that's just what I've been wishing for; but there's not an engine on that side, so you had better go back to your work."

"Wouldn't they give you that engine on the passenger train?" I persisted.

I had blundered on a good thing.

"Confound it," he exclaimed, "I should have thought of that myself! Run over to the operator and tell him to wire the superintendent that I must use the engine off train number 3; answer."

I flew, and in five minutes returned with a message, "O. K., use any engine you need."

"Now, scoot for that engine," I was commanded, "and tell the engineer to back down to the crossing and come up the east-bound main."

I started before he was quite through, and covered the mile or more in record time, arriving breathless and hatless, so important did my mission seem.

But a passenger engineer, while alert to his duty, is oftentimes, and especially when he has lain back of a wreck for an hour, a most deliberate animal.

This one was Dick Burt, grown gray at the throttle, and evidently not tickled to death at the prospect of playing draft horse at a freight wreck with a haughty express racer; for instead of being impressed with my haste, he made me repeat the Old Man's order and show the superintendent's telegram, which had been given me.

After which he coolly took a chew of tobacco, told the fireman all about it, then blew five long blasts with the whistle, as a signal for the flagman to go back, and finally slowly backed his train down toward the crossing, without inviting me to ride, and leaving me standing on the track filled with a queer mixture of chagrin and envy.

I began to retrace my steps at a very much slower pace, keeping a sharp lookout for my hat, which had blown off, and when about one-third of the way back I discovered it hanging on a bush alongside of the road.

I presently discovered a little spring of water close to a bank covered with undergrowth, and decided to take a good drink and hurry back to the wreck.

As I stooped over to dip my face in the water, I saw an apparition that made me jump back with a cry of terror, it was so unexpected; for gazing up at me was the reflection of a man's face, not my own, with wild, bloodshot eyes and the hunted look of desperation.

I quickly looked up and saw the man in the bushes just above me.

"What the deuce are you doing up there?" said I, trying to speak calmly.

"Say!" replied he, in a ridiculously out-of-place stage whisper; "do you belong to that wreck crew working up there?"

"I do," said I, with a sort of pride.

"How many were killed?" asked he, with a wavering note of fear in his voice.

"None," said I; "they all jumped."

"Thank God!" he shouted; "thank God for that!" and he sprang down beside me.

I was dumbfounded.

"Say, young fellow," I inquired, speaking the first thought that came to me; "did you have any relations in those train crews?"

"No, no; far worse than that; but, by George!" with sudden resolution, "I'm going to face the music now, if it means state prison."

On the way back he told me all about it; and when he had finished I found a big tear in each of my eyes.

"I'm the regular night operator at P X tower," he began, "and Jim White has the day trick.

"Jim and I have been close friends for years, and learned operating together up in the yardmaster's office at D——.

"The division operator took a sort of fancy to Jim; his work was always clean-cut, and he got a reputation up in the main office for being the only man who could take Jack Bell, the dispatcher's 'crack-a-jack,' without opening the key on him.

"So Jim got promoted, and was given the day job at P X, the little girl he'd been engaged to for about a year coming with him as his wife. They settled down in a little five-room house on a three-acre mountain farm, and seemed as contented as though they had both been brought up to it.

"Bessie, that Jim's wife, fixed the inside up as cozy as a bird's nest, and when the little bird came Jim was the craziest happy man I ever saw.

"As luck would have it, three months later I was sent there on the night trick, and dear old Jim insisted that I should live with them, and I did, after trying rough mountain board for a couple of months.

"Oh, what a sweet little darling Jim's baby grew to be; he twisted himself in knots around my heart as I never thought a youngster could; and, say! talk about smart; he was only two and a half years old last May, and could take his little fork on a plate and click off 'Mamma,' 'Papa,' 'Baby,' 'Uncle Bob' (that's for me), without a mistake. Jim and I taught him, though Bessie said it was a shame to force a child's mind so.

"He took sick last Friday with some little rash or other, and as he didn't seem to be any better when I came off duty in the morning, and as Bessie and Jim were getting worried, I walked six miles over to Rocktown for the doctor.

"The doctor said it was scarlet fever when he saw him, and left some medicine. But it didn't seem to do him much good. Baby got worse and worse, poor Bessie was worried half sick, and Jim was frantic to get out of the tower and home to his stricken treasure.

"I relieved him toward the last, and worked night and day for two days to give him time at home.

"Last night he came into the tower about eight o'clock, his face set and rigid, and I knew that it was all over.

"Bob," he whispered, "Baby's dead: can you stand it another night? I'm afraid Bessie'll lose her mind if I ain't there."

"I couldn't speak; I only nodded, and when Jim had gone, burst into tears.

"But I had over-rated my powers of endurance, and as midnight came and passed I got so drowsy I simply couldn't keep my eyes open.

"Time after time I rose and paced to and fro, slapping and pinching myself to keep awake, until the last time, when the dreaded thing had happened, and I knew that all was lost.

"I don't know how far I wandered in the dark, through the woods and over rocks, but as daylight broke some sense returned, and I felt that anything was better than the horrible uncertainty that I was a murderer.

"Oh, thank God, no one was killed!"

A few moments spent in gulping down a lump in my throat, and then I said, "My friend, I don't know what your last name is, but you are a brick; and my advice is to go straight to the superintendent and tell him what you have just told me."

"My name is Bob Willits," said he.

"Mine's George Darlington," I replied, and we shook hands.

That some corporations have souls has often been proved. Willits took my advice, and the only punishment he received was to be sent to another division of the road.

My slightly prolonged absence had apparently been unnoticed by the Old Man, who was using the passenger engine for all it was worth, and had already got the "dead" engine dragged out and on her own wheels, and was working the derrick successfully to raise the one still left lying on the track we were clearing.

It was just four o'clock in the afternoon when we finished and started for home, working like horses to get everything ship-shape again aboard the wreck train, for all must be in order before we can leave the cars.

When we got back to the shop yard the other men had all gone home from work, and we quickly followed their example.

I was anxious to see Ike Rhodes and post him about the excuse I had given for taking his place; but his first words made my heart sink.

"Say, George, I am much obliged to you; but Tom Fletcher heard this morning that you had gone with the wreck crew because I was sick, and he came over here and found out that I wasn't sick at all. He will be laying for you with a sermon to-morrow and will report you to the Old Man."

Fletcher eyed me with a long face next morning, and said: "George, 'A liar is an abomination unto the Lord;' " from which text he preached a short sermon in a melancholy voice, and wound up by saying that he had reported me to Mr. Strong, and hoped he wouldn't suspend me for more than a week.

Shortly after I was called into the Old Man's office, fully expecting to meet trouble.

"Darlington," he began, "I am very much pleased at the way you worked at the wreck yesterday, and particularly about your suggesting that passenger engine. You can report to-day to Tim Duncan, gang boss on the other side, and will be a regular member of the wreck crew. Your pay will be increased to twenty-five cents an hour."

"Thank you, Mr. Strong," I said, and turned to leave the office.

"One minute, Darlington," said he, detaining me; "there's one thing I would like to say to you.

"Never tell a lie."

Fast Engine for France.

The four fast express engines for the French State Railroad, now being built at the Baldwin works, need only a regulation American pilot to make them a typical United States locomotive. They are neat-looking, clean-cut machines, and the general appearance indicates great speed capabilities with light trains. The engines are of the eight-wheel type, with four-wheel pony truck. They have the Vauclain compound cylinders, the boiler is built for 215 pounds of steam pressure, and the driving wheels are 84¼ inches in diameter. The gage is 4 feet 9⅛ inches, and the total weight in working order 112,945 pounds. The light weight in proportion to steam pressure and diameter of driving wheels is somewhat peculiar.—*Pittsburgh Post.*

PERSONAL.

Mr. W. J. Bennett has been appointed master mechanic at Slater, Mo., on the Chicago & Alton.

Mr. F. B. Shepley has been appointed purchasing agent of the Fitchburg, with office at Boston, Mass.

Mr. John D. Sanson has been appointed traveling engineer of the Toledo, Peoria & Western at Peoria, Ill.

Mr. Thos. W. Smith has been appointed superintendent of the Duluth, South Shore & Atlantic at Ishpeming, Mich.

Mr. George T. Slade has been appointed general manager of the Erie & Wyoming Valley, with office at Dunmore, Pa.

Mr. W. Harrington has been appointed division master mecnanic of the Western division of the Fitchburg at Mechanicsville, N. Y.

Mr. E. H. Symington has been appointed assistant master mechanic of the Eastern division of the Fitchburg, with office in Boston, Mass.

Mr. E. S. Walker has been appointed master mechanic of the Southern Indiana at Bedford, Ind., succeeding Mr. Alex. Shields, resigned.

Mr. A. G. Elvin has been appointed master mechanic in charge of the Montreal shops of the Grand Trunk, vice Mr. William Aird, resigned.

Mr. W. V. Butterfield has been appointed general foreman of the Central of New Jersey at Phillipsburg, N. J., vice Mr. C. H. Weeks, resigned.

Mr. W. L. Stevenson has been appointed superintendent of the Eastern division of the Fitchburg, vice Mr. J. R. Hartwell; office at Boston, Mass.

Mr. J. G. Rogers has been appointed superintendent of the New York, Philadelphia & Norfolk at Cape Charles, Va., vice Mr. R. H. Nicholas.

Mr. Mark P. Reed has been appointed general foreman of the Kansas City, Memphis & Birmingham at Amory, Miss., vice Mr. R. H. Briggs, resigned.

Mr. W. H. Whalen has been appointed division master mechanic on the Chicago & Northwestern at Baraboo, Wis., succeeding H. T. Bentley, transferred.

Mr. S. K. Dickerson has been appointed master mechanic of the Toledo division of the Lake Shore & Michigan Southern, with headquarters at Norwalk, Ohio.

The announcement is made that President J. M. Crafts has resigned the presidency of the Massachusetts Institute of Technology, the resignation to take effect at the end of the present school year.

Mr. George H. Emerson has been appointed general master mechanic of the Great Northern and the Willmar & Sioux Falls, with headquarters in St. Paul, Minn.

Mr. J. C. Nolan has been appointed assistant superintendent of the Montana division of the Great Northern at Havre, Mont., succeeding Mr. F. J. Haun, transferred.

Mr. F. J. Haun has been appointed superintendent of the Breckenridge division of the Great Northern at Breckenridge, Minn., succeeding J. M. Davis, resigned.

Mr. Riley Williams, trainmaster of the Grand Trunk at Battle Creek, Mich., has resigned to accept the position of superintendent of the Indiana, Illinois & Iowa at Kankakee, Ill.

Mr. R. H. Briggs, general foreman at Amory, Miss., for the Kansas City, Memphis & Birmingham, has been appointed master mechanic of the North Alabama at Sheffield, Ala.

Mr. Thomas McHattie has been appointed master mechanic of the Eastern division of the Grand Trunk; headquarters at Montreal. He was previously acting master mechanic.

Mr. Thos. Roope, master mechanic of the Sioux City & Northern and Sioux City & Western, has been appointed master mechanic of the Willmar & Sioux Falls at Sioux City, Ia.

Mr. M. E. McKee, for many years superintendent of air brakes on the Great Northern, has resigned to accept a position with the International Correspondence Schools of Scranton, Pa.

Mr. O. M. Foster, traveling engineer of the Eastern division of the Lake Shore & Michigan Southern, has been appointed general foreman between Erie and Buffalo, with headquarters at Buffalo, N. Y.

The position of assistant superintendent of motive power on the Lehigh Valley has been abolished, and Mr. John S. Lentz has been appointed master car builder of the Easton & Amboy and Lehigh divisions.

Mr. F. H. Greene, chief clerk to the superintendent of motive power of the Lake Shore & Michigan Southern, has been appointed purchasing agent, succeeding Mr. C. B. Couch, resigned; office at Cleveland, Ohio.

Mr. Brown Caldwell, recently secretary of the Peerless Rubber Company, has assumed the position of general Eastern representative of the Sargent Company, of Chicago, and will have offices in Pittsburgh and New York city.

Mr. John L. Mohun has been appointed master mechanic of the Belvidere division of the United Railroads of New Jersey at Lambertville, N. J. He was previously assistant to the master mechanic of the Pennsylvania at Juniata, Pa.

Mr. Charles Dyer, superintendent of the Colorado division of the Atchison, Topeka & Santa Fé, has resigned to accept the position of general superintendent of the Colorado & Southern at Denver, Col., succeeding Mr. T. F. Dunaway, resigned.

Mr. T. W. Demarest, master mechanic of the Pennsylvania at Logansport, Ind., has been appointed superintendent of motive power of the Pittsburg, Cincinnati, Chicago & St. Louis at Columbus, Ohio, succeeding Mr. S. P. Bush, resigned.

Mr. F. W. Diebert, master mechanic of the West Milwaukee shops of the Chicago, Milwaukee & St. Paul, has resigned to accept the position of assistant mechanical superintendent of the Baltimore & Ohio at Newark, O., succeeding Mr. I. N. Kalbaugh.

It was erroneously stated in our January number that Mr. W. D. Robb, master mechanic of the Grand Trunk at Toronto, had resigned to become superintendent of motive power of the Central Vermont. Mr. Robb has no intention of leaving the Grand Trunk.

Mr. T. A. Heintzleman, master mechanic of the Southern Pacific at Sacramento, Cal., is the inventor of a pneumatic device for working the ashpan dampers. This device has a 2-inch cylinder, takes its supply of pressure from the main reservoir, and is being applied to all engines as they go through the shop.

The following changes have been made on the Pennsylvania: Mr. P. F. Smith, master mechanic at Crestline, O., has been transferred to Logansport, Ind., succeeding Mr. T. W. Demarest, promoted. Mr. G. L. Wall is appointed master mechanic at Crestline. Mr. Louis Kinnaird is appointed assistant master mechanic at Allegheny, Pa.

Mr. A. L. Moler has been appointed general foreman in charge of locomotive and car departments of the Chicago & Alton Railroad at Brighton Park and Chicago, vice W. J. Bennett, transferred. Mr. Moler was at one time master mechanic of the St. Louis, Peoria & Northern Railroad, and later was with the Baldwin Locomotive Works in charge of erecting engines for the domestic trade.

One of the saddest announcements we have received in a long time was a mourning notice sent out by The McConway & Torley Company, of Pittsburgh, Pa., announcing the death of their secretary and treasurer, Charles P. Krauth. Mr. Krauth was one of the most popular railway supply men, and a very large circle of friends mourn his untimely end, for he was cut off in the flower of his manhood.

Mr. Wm. Hassman has been appointed superintendent of motive power of the Central Vermont, in place of Mr. C. E. Fuller, resigned; office at St. Albans, Vt. Mr. Hassman entered railroad service with the Philadelphia & Reading, as machinists' apprentice, and continued with that company until 1877. He afterwards filled several positions with different roads, and leaves the Illinois Central to take his present position.

Mr. C. J. Brittingham, of the Chicago & Alton Railroad, whose headquarters were at Bloomington, has been transferred to the Western division, with headquarters at Slater, Mo., as road foreman of engines and air-brake instructor. Mr. Brittingham came to the Alton about a year ago from the Big Four, and has been for some months engaged in the duties of looking after fuel economy and the operation of the locomotives.

Mr. Joseph Cockfield, master mechanic of the Iowa division of the Chicago & Northwestern, has resigned. Mr. Cockfield has been with the above road for thirty years, and was advanced from the position of machinist to that of master mechanic. Mr. Cockfield leaves the Chicago & Northwestern with the good will of all, and can furnish recommendations from the best men on the Northwestern. He is open for a position on some small railroad.

Mr. John Ellis, master mechanic of the Maine Central, has been relieved of the details of the locomotive department, and will devote his attention to steamboats operated by the company. Mr. Ellis has been in active railroad service about forty years, and nearly the whole time in an official capacity with the Maine Central and its leased lines, and is deserving a well-earned rest. H. N. Webber, general foreman, will assume his duties at the Waterville shops.

Mr. J. P. Kelly has been appointed road foreman of engines and air-brake instructor for the Eastern division of the Chicago & Alton Railroad. Mr. Kelly came up through the locomotive department as a locomotive engineer on an Eastern railroad. He has been an air-brake instructor for the American Magazine League, and later was one of the experts connected with the New York Air-Brake Company. Mr. Kelly has been a contributor to the columns of the Air-Brake Department of Locomotive Engineering for some years.

Mr. R. P. C. Sanderson, assistant superintendent of motive power of the Norfolk & Western, has resigned to become assistant to Mr. John Player, superintendent of machinery of the Atchison, Topeka & Santa Fé, at Topeka, Kan. We understand that Mr. Sanderson will have charge of the enginemen and of all outside work connected with the motive power department. He will take charge of the different shops, and relieve Mr. Player of much of the detail work which he has been accustomed to perform. Mr. Sanderson is a remarkably able mechanical engineer, and there are few men who have investigated engineering problems who have carried on the work with more impartiality than he has done. His deductions in regard to experiments have, therefore, been peculiarly valuable.

The consolidation of the Flint & Pere Marquette Railroad, the Chicago & West Michigan Railway, the Detroit, Grand Rapids & Western Railroad, and the Saginaw, Tuscola & Huron Railroad into the new corporation named the Pere Marquette Railroad, has made several changes, among which we note the following in the locomotive department: Mr. B. Haskell has been appointed superintendent of motive power of the Pere Marquette Railroad, with headquarters at Saginaw, instead of Grand Rapids. Mr. T. J. Hatswell, master mechanic at Saginaw, has resigned, and Mr. W. K. Christie, master mechanic at Muskegon, has been transferred to Saginaw to succeed him. The jurisdiction of Mr. W. T. Rupert, master mechanic of Ionia, has been extended to take in the Chicago & Michigan Railroad. This part of the system is now called the Grand Rapids district. Mr. Edward F. Essick, machine shop foreman, has been appointed general foreman of the locomotive department at Muskegon. Mr. D. McKinley has been appointed general car foreman at Muskegon. Mr. W. H. Canan has been transferred from Grand Rapids to Saginaw as engine-house foreman. Mr. John Snyder has been transferred from New Buffalo to Grand Rapids as general foreman. Mr. Louis Cloutier has been transferred from Traverse City to New Buffalo as general foreman. Mr. A. Gibson has been appointed general foreman at Traverse City, in place of Louis Cloutier, transferred.

From the West to the East.

Superintendent of Motive Power J. N. Barr, of the Baltimore & Ohio, who came from the Chicago, Milwaukee & St. Paul, has selected F. W. Diebert, master mechanic at the West Milwaukee shops of the St. Paul, as assistant superintendent of motive power on the Baltimore & Ohio lines west of the Ohio river, with headquarters at Newark, Ohio. It is rumored now that about twenty of the best engineers on the St. Paul road will come here to work for the Baltimore & Ohio system. Mr. Barr proposes to make some important changes in the Baltimore & Ohio methods in taking care of the motive power. He is a thoroughly practical man and has the reputation of being a very affable gentleman.—*Pittsburgh Post.*

S. Dana Greene.

The sudden death of S. Dana Greene, general sales manager of the General Electric Company, by drowning at Schenectady on January 8, brings much sorrow to all who knew him.

His connection with this enormous electrical manufacturing establishment proved his ability as a business man, and the prompt offer of his services in the late war showed his public-spiritedness.

The car-brake inventor has gone back to one of the first principles and patented the chain brake that winds up on the axle when the friction band is tightened. We don't know how many times this has been used, but if anyone will ask some of the old engineers of the Pennsylvania, men who were there thirty years ago, they'll find one case where it didn't go.

Rambling in the Sunny South.

EDITORIAL CORRESPONDENCE.

When the combinations of misery known as piercing frost-moistened winds begin to tell the people of New York and its environs that January's demonstration of winter is something to be feared, the person with thin blood and rheumatic tendencies loses his courage. When the tower-like buildings are swayed by winds that find air-forced passages through every casement, when the same winds take away his breath within the forest-protected fields of suburban homes, he is liable to capitulate, if the stern necessities of work do not tie him down like the mythological maiden to the inexorable rocks of power.

Sentiments of duty and power were strong enough on the writer about the first week of the year, but a vision kept obtruding itself of sunny skies, moist air and healing winds in Florida's pine-covered regions, and the picture became so alluring that he became convinced that an immediate visit to Florida and the regions thereabout was necessary for the best interests of LOCOMOTIVE ENGINEERING. When you want anything it is not difficult to convince yourself that it is necessary.

Early in the month I was speeding southward on one of the luxurious trains that make the long journey from New York to New Orleans a delightful pleasure trip. I did not make a very long journey, but divided my trip into comfortable sections that admitted of traveling most of the way in daytime, a thing everybody should do who wishes to enjoy the varied and picturesque scenery that makes a Southern tour like a long panorama.

SOUTHERN SHOPS AT SPENCER.

My first stopover was at Salisbury, N. C., which has received enduring glory within three years through the Southern Railroad building fine, extensive repair shops two miles out, at a place which has been called Spencer, after the president of the road, a second Depew in fact. There was plenty of land available at the point selected, which is an important consideration in building new shops. The ground is rolling, and affords excellent facilities for drainage, not only for the workshops, but for the dwelling houses that are springing up for the accommodation of the workmen.

It is to be presumed that very serious consideration was given to the planning of the shops, and that the officials visited the leading shops in the country to find out all the strong and weak points connected with those in use. They adopted the plan of having the coaling bins, water tank and sand house on the entrance track which leads to a spacious roundhouse, which is already too small, but can easily be enlarged. The repair shops are housed in three large buildings that are set parallel with each other and are served by transfer tables. Supply tracks pass both sides of the buildings, and the best of facilities are provided for moving material. Beyond the tracks on one side, well removed from the main buildings, are strung along oil houses and repositories of other inflammable material, great care being exercised to prevent fires. On the other side are general storehouses, offices, and near them platforms for the storage of castings, forgings and other heavy material. Great attention is bestowed upon the selection of scrap, and the various kinds are neatly stored in bins convenient for shipment. Everywhere, in shops and yards, cleanliness and neatness prevails. The scrap is not scattered about the yards and hiding nooks, but is promptly sent to the bin where it belongs. There is no greasy waste lying about or abandoned material of any kind. There seems to be a place for everything and everything is in its place.

These, like all other repair shops belonging to the Southern Railroad system, do the locomotive and car repairs for a certain district. The Spencer shops do the work for 1,313 miles of track, employing 168 locomotives. Work is very active in the shops at present, and they employ about 580 men, some of whom are at minor division points. Under the supervision of this point there are 321 locomotive engineers and firemen, which, together with the shop force, makes up the nucleus for a pretty good sized town.

The machine shop and erecting shop are in one building, the erecting stalls, ten in number, being set across the floor on one side, while the tools are arranged on the other side. There is no overhead traveling crane, which would not be a paying investment for a shop with less than fifteen stalls, but it will be easy to put in cranes when the time for extension comes. The shops have been planned with the idea that extension would be called for within a few years, and that can be carried out without interfering with the current work.

They have so many traveling hoists for helping to lift and move material that the absence of overhead cranes is scarcely felt. In the roundhouse there are two drop pits, which lower any pair of driving wheels or truck. All the larger tools have air hoists. The tools are so arranged that the heavy work, such as driving wheels, frames, cylinders, etc., is moved with the least possible amount of handling from the serving track to the tool. The floors of all the principal shops are of brick, laid on a substantial foundation, and it makes as good a floor as anything I have seen. I noticed at one part of the erecting shop, where heavy material is swung by a hoist from the cars, that the floor is strong planking, a material that can stand a heavier bump from a pair of wheels than brick, and can be easily replaced.

As a rule the tools are good, but there are a few legacies from small, ancient roads absorbed that could be exchanged with advantage for more modern patterns. This change will no doubt come in the near future, for the company have recently contracted for a great many new tools, the policy being to provide the kind of facilities for doing work economically that would be considered necessary by a manufacturer.

There are some good features about these shops that are well worthy of imitation. They have been located, designed and built in a way that admits the clear light of heaven without stint or hindrance. They are comfortably heated by the Sturtevant system, and the same system has been applied to the planing mill to carry the chips and shavings from the tools to the boiler room. At night when artificial light is needed, electricity gives not a bad substitute for sunlight, but not quite as good or as cheap. They have a very fine electric lighting plant, and provide lighting for the passenger station and yards, two miles away.

I don't know who designed those shops, but I think that it was Mr. W. H. Thomas, superintendent of motive power, in consultation with the chief engineer. The tools, I think, were put in under the supervision of Mr. W. H. Hudson, now master mechanic in charge. The whole of the work reflects much credit upon all connected with it. Mr. Hudson has remarkably efficient help in Mr. M. A. Shank, general foreman of the locomotive part, and of Mr. W. E. Looney, foreman of the car department.

From Spencer I went to Savannah. While writing about that journey it is a good time to testify to the fine condition of the Southern Railroad roadbed, to the elegance and comfort of its cars, and to the magnificent condition of its locomotives, which seemed capable of catching on to schedule time, no matter how long the delays were at stations, or how many cars were put on. The operation of this railroad gives a good illustration of the advantage of having engines with a liberal margin of reserve power.

The trip lasted two weeks, and a large number of shops—good, bad and indifferent—were visited, but there is not room to give more particulars in this letter.

S.

Quite reliable report has it that James J. Hill, president of the Great Northern Railroad, seriously contemplates building and operating a steel plant at Great Falls, Mont., of sufficient capacity to manufacture steel rails, bridge steel and other articles used in building and maintaining a large railroad.

Manning, Maxwell & Moore, New York, are preparing to publish a fine catalogue of the tools they handle. Better engage one in time.

Railroad Combinations.

The month of January has been notable for the rumors circulated concerning projected consolidation of railroads. Some of the rumors have been well founded, but others had little, if any, foundation in facts. The Lake Erie & Western has passed into the hands of the Vanderbilts, and will be operated as part of the Lake Shore & Michigan Southern. Reports had it that the Big Four and the Chesapeake & Ohio had come under Vanderbilt control. This was not entirely correct, but we understand that the Vanderbilt people had secured a controlling interest in the Big Four, and that they had combined with the Pennsylvania Railroad Company in purchasing a joint interest in the Chesapeake & Ohio. In connection with this it was said that Mr. M. E. Ingalls, president of the latter railroad, was about to resign, but it will not be before midsummer.

The great capitalists who have interests in the railroads doing most of the through business between the Missouri river and the Atlantic seaboard have tried many expedients to prevent the ruinous rate cutting resulting from fierce competition, but hitherto without success. They have now adopted the policy of securing sufficient interest in all the leading lines to control the management. The Pennsylvania people have purchased considerable interest in the Baltimore & Ohio, and other combinations have been formed which will assure harmonious action in the maintenance of rates.

This will be much better for the railroad companies, railroad employés and for the general public than the policy of the competing warring against each other. An erroneous belief has prevailed in many quarters that shippers of goods by rail and the public generally benefited from rate cutting; but that was a mistake. Stable rates are better than uncertainty, and the assurance that the cost of transportation will be the same next year that it is to-day enables merchants and shippers to tell in advance what their wares can be sold for.

An ingenious arrangement to prevent overcrowding of stairways and elevators when entering or leaving a building is used in the main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow, so that the employés on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employés on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by the International Correspondence Schools.

Aaron French the Philanthropist.

It is well known that Mr. Aaron French, the famous spring maker of Pittsburgh, is one of the kindliest and most charitable men in Pennsylvania. In his acts of benevolence Mr. French is very secretive, but they are sometimes discovered and made public. A recent dispatch from Atlanta, Ga., reads:

"Aaron French, the capitalist and philanthropist of Pittsburgh, Pa., has again come to the rescue of the Georgia Technological School, practically opening the doors of that institution with a gift today of $3,500.

"The classes of the school are crowded to overflowing, and the State appropriation is insufficient to provide means of accommodating new scholars. The trustees asked the recent Legislature for an additional sum, which was refused, whereupon the faculty was compelled to issue a circular announcing that no more students could matriculate until October of the present year, whereas the custom has been to open the doors on February 15.

"On learning of this condition, Mr. French immediately sent his check for $3,500, and the faculty is preparing to issue a supplementary circular which will announce that new scholars will be admitted on February 15, as usual.

"This donation runs the sum of Mr. French's contributions to this single institution up to $16,000. Previously he had given amounts aggregating $12,500 toward the erection of a textile department, to be known as the 'French Textile School.'

"Thus is presented the unique spectacle of a Northern man opening the doors of a Southern institution."

Ticket and Passenger Agents Dine.

The large dining room of the Hotel Marlborough was filled by a merry crowd of the passenger and ticket agents of the various railroads centering in New York and having offices on Broadway, on the evening of January 10th.

It was the occasion of their semi-annual dinner, and those who were unavoidably absent missed a rare treat.

The officers of the association are A. E. Hill, Chicago & Northwestern Railway, president; G. C. Dillard, Atchison, Topeka & Santa Fé Railway, first vice-president; Samuel Smith, Erie Railroad, second vice-president; W. F. Miller, Lehigh Valley Railroad, secretary; L. E. Westbrook, Grand Trunk Railway System, treasurer; Neil Mooney, West Shore Railroad, corresponding secretary, and Frank Johnson, New York Transfer Company, sergeant at arms.

Many of the general Eastern passenger agents were present, and were called upon for remarks, which were listened to with great pleasure.

Those who answered to the several toasts were H. B. Jagoe, general Eastern agent, West Shore Railroad; E. F. Burnett, general Eastern passenger agent, Atchison, Topeka & Santa Fé Railway; E. D. Spencer, of the Lehigh Valley, the "Edwin Forrest" of the association, and many others.

A more bright, intelligent body of young men are seldom gathered together, and it requires no stretching of the imagination to look ahead in the near future, and see them occupying the chairs in the more responsible positions now filled by their superiors.

The Scranton Schools.

The rapid growth and remarkable popularity of schools of correspondence prove that this new system of education meets a direct want. Starting about ten years ago with a single course in mining, The International Correspondence Schools of Scranton, Pa., have developed so rapidly that they now teach by mail over seventy courses and have over 130,000 students on their rolls. Most of the students are residents of this country and Canada, but the schools have a large following in foreign lands. Students in twenty of the Mexican States are enrolled in the schools, and almost as many European countries are represented. That no country is too remote to be reached by the correspondence school is shown by the records of students in South Africa, Australia, Tasmania, Siam and Korea, who are successfully educating themselves through the courses of the International Correspondence Schools.

The New York Air-Compressor Company's new shops at Arlington, N. J., commenced operation in all departments but the foundry upon January 2d, and the company expects to have its foundry at work by February 1st. Although organized but a little over sixty days, the sales record of this company is remarkable, orders having been placed with it sufficient to tax its capacity for three months. Plans have been made to double the shop equipment at once, and the plant will be operated day and night until this is done.

We are informed that the Great Northern Railroad has evolved a scheme for selling stock to its employés. No employé will be allowed to invest who draws a higher salary than $3,000 per year. The stock, which is now worth $175 per share, will be sold in sums not to exceed $5,000. The company expects that many of the employés will take advantage of this opportunity to safely invest their earnings.

The latest curiosity to be found in Texas is a steam whistle 74 inches long and 15 inches in diameter. That horrible ear splitter is said to have been installed at the Gulf, Colorado & Santa Fe shops at Cleburne.

The Traveling Engineer.*

BY C. B. CONGER.

The duties of a traveling engineer are so varied and there is so much difference between those assigned to him on one system under one management, as compared with his duties under another management or on another system where the conditions are different, that it is hard to define them without giving him such a long list of possible duties that he will be overloaded right from the start. The title also varies; on some lines he is a traveling engineer, which implies that he is an engineer that is not confined to one run or one engine, but is assigned to duty on any or all engines at all points of the district in his charge, with the especial duty of inspection of the machinery and its work. On other lines the title is road foreman of engines. If we compare him with a shop foreman of engines, we will expect to find him in charge of the men and engines after they cross the turntable and are assigned to the proper train. The shop foreman's duties relate to the repairs and maintenance of the engines, getting them ready for the next trip, with crew, tools and supplies ready for the work. The road foreman then takes charge, and sees to it that the best possible use is made of the power under the orders of the superior officers. For that reason he is required to keep in close touch with the officers above him, both in the mechanical and transportation departments, as they see the work done through his eyes, in a measure, and he is the particular representative of the officers, who should be in the closest touch with the engine men.

On some roads he reports directly to the officer in charge of the locomotive department, and is thus able to keep him informed as to the condition of the engines, the way that they are operated, and help out the superintendent of motive power in getting the best results from the equipment. This method makes him a mechanical man, both for road work and suggested repairs.

On other lines he is under the transportation department alone. Having nothing to do with the locomotive department, he does not report to them. This method makes him a sort of trainmaster, whose particular forte is the operation of locomotives.

No matter which department he is attached to, his services are valuable in direct proportion to his ability, the respect the men have for his instruction and orders, and the support he gets from his superior officers.

His duties require that he shall know about the condition of the locomotives and their ability to do the work assigned to them. To do this properly, he should ride on them when they are hard at work, or he will not know exactly how it is done under all conditions. When the engines are pooled, or the supply is so short that it is impossible to do all the repairs necessary for their economical operation at the time they are getting ready for the next trip, his work is more exacting and his responsibility more decided.

The man in charge of the engines when they are hard at work is the best judge of their condition, and what work is needed on them or what can go undone till a later season. But we do not always find that the proper attention is paid to his reports by those above him. Engines are not always repaired as his reports suggest.

As they see through his eyes and depend on him for a detailed account of the operations on the road, he is in a disagreeable position when anything goes wrong or any of the rules of the company are violated. His duty sometimes is best performed by being merciful and helping out the trouble, with a view to preventing a recurrence of it by other means than sharp discipline.

There are many little troubles on a railroad every day, which do not cause any delay or damage, which can be magnified into something very bad if so desired; but if the opposite course is taken, will soon become obsolete. By this I do not mean infractions of the rules for movement of the trains or any of the rules for the safety of passengers or fellow employés; only discipline proportioned to the magnitude of the offence can be used for such cases, to make running of trains safe.

The ability of a man, however, in a great measure defines his duties. If he is a specialist in any one line, he is likely to be called on for that kind of work more often than for some other line in which he is not so successful. If he is a good all-around railroad man, he will be called on for a multitude of different classes of work. A general "handy man" is highly appreciated by all, both above and below him, and this appreciation is usually shown by keeping a long list of work laid out for him, "when you get around to it."

With his duties so varied, his requirements and abilities must be correspondingly varied. He should have a mechanical education—certainly the practical part—and the theoretical part comes very handy, even if he uses it only for his own information and to keep up with the progress of the age. In these later days, when there is so much clerical work required to make everything a matter of record by written reports, a man who cannot clearly express what he knows labors at a great disadvantage, no matter how efficient he may be in a general way. If he is not a reader of the current railroad papers, he will not be able to keep up with the improved methods of other roads. This means that he will get the reputation of being a back number with the progressive

* Written for Pacific Coast Railway Club.

men on his own road; this is fatal to his usefulness.

If in addition to having a good mechanical education, which he can put to practical service, he is a close observer, he is well equipped for his duties. To compare the man with the education alone and the close observer whose technical education is limited, the close observer is the better man; for that is a natural gift or talent born in some men and carefully cultivated till it has a commercial value. An education in mechanical matters can be acquired even late in life if a man puts his whole energy into it.

If he has tact in addition to his other qualifications, he is still better endowed for the position. There is so much friction in railroad operations, between the different grades and branches of the service, that a traveling engineer without discretion can stir up, unwittingly, troubles that otherwise would remain dormant, and instead of making the rough paths smooth for all to travel on, can have a jangle all the time. Where he has the discipline and assignment of men as part of his duties, it is usually more trouble than all the rest of his work put together, particularly if his orders are reversed by higher authority; that will break down his influence and authority at once.

The traveling engineer should have the ability to teach to others what he knows that they should know. When a reform is started in any of the work, he should be able to lead and show the doubting ones that it can be done. A few failures should not daunt him; he expects those under him to go right on past failures to final success, and he must be able to do that himself. It is a hard job to go ahead and practice what you preach and interest the others; but ability to teach others is more highly respected than your own store of knowledge. If you keep it all to yourself, it is no credit; impart it to others so they can use it, and it benefits both of you. Incidentally, we might here state that the reformer on a railroad has a hard road to travel.

If there is no regular air-brake instructor, the traveling engineer usually has included in his duties the proper operation of the brake on the road. He can note and correct at the time many errors, and thus help out the service, both in smooth handling and economy of maintenance.

As the use of fuel comes directly under his charge, a man who is not a practical engine man is at a disadvantage. He should be able to *show* the new beginner how to fire, and explain to him why it should be done that way, as well as correct the careless work of the man who may have shoveled coal for years and not used the proper methods. An object lesson is the only one that is convincing. A traveling engineer who can do a good job of firing on any of the engines is a long way ahead of the theorist, even if he does not take hold of the scoop every time. Fuel economy is where a competent man can make the most saving in money for his company. If he has the ability to adjust the drafting arrangements so the engines will steam freely, he is indeed valuable. In making fuel tests, or, in fact, any tests where the work of the engine is closely watched, while the apprentice or technical man can look after measurements of coal and water and collecting correct data better than anyone else, yet the manner of operating the engine cuts quite a figure in the efficiency of the fuel or engine, and he is the best judge of skillful operating.

The matter of mechanical examinations to determine what a man knows before he is promoted from fireman to engineer comes directly under the traveling engineer. If this matter is attended to by a board of examiners, he should be one of them. A candidate for promotion may be well posted and yet cannot explain what he knows fully; but if he is with a man who is on the engines daily, he can make himself clearly understood.

He should be a member of a trial board whenever an engineer or fireman is on trial for any trouble. He is more conversant with the locality and its conditions, as well as the machinery in use at the time of the trouble.

On some lines he is responsible for hiring the engineers and firemen. Where he does not have this power, his recommendations, at the time the men are finally placed on the permanent list, should have due consideration.

The requirements for successful work as a traveling engineer are not all on his side. The officers have a large share of the responsibility for his success. They must put out wise rules for the guidance of all, and then see that they are observed. They must not expect him to take anything but a manly and straightforward stand between man and man, with no favorites to reward and no enemies to punish. They must back him up solidly when he is obeying their instructions, and show by their daily intercourse with him that he has their confidence, and, above all, not leave him friendless when he complies with orders that are disagreeable to execute.

One prominent officer has said that sometimes the "science of railroading is shifting the responsibility on some other fellow." The traveling engineer cannot do this; he has to play fair and carry his own load or he is in trouble all over.

One mistake made is to appoint a man from one of the best runs on the road, with a good lay-over at home, where he has a chance to use that advantage to get posted so as to keep up to date, then at once cut his pay down and increase his expense bill till his net earnings are only a fraction more than the poorest-paid men, and then expect that he will put his whole heart into the work. He runs just as many risks while he is out on the engines as he did when running one, besides the added responsibilities. Promotion is sought for as a step towards increased earnings, not for an easy berth, and good work should have good pay.

Can we find this ideal engineer? Yes indeed, there are hundreds of them now in service, and hundreds more in the ranks who are well equipped for performing all the duties that ordinarily are assigned to them.

This is an age of progress, and the active men in the locomotive department keep up to date in the latest and nearest perfected methods. That they are useful and appreciated is shown by the rapid increase in their numbers in the last two years, and the increase in their authority and responsibilities. A good man can save his salary many times over each month, without taking anything from anyone else that belongs to him.

If there are any who are not successful, it is not always the fault of the plan, and the failure of a few shows out in a brighter light the success of the many.

We have numerous energetic agents who canvass very energetically for subscribers to Locomotive Engineering, and they frequently hear curious objections raised against the paper by those who are reluctant to hand over two dollars. One lie that has been threadbare in the South this season has been the assertion that the editor was using what influence he has with railroad officials to have them strictly enforce the examination of enginemen before making them eligible for appointment or promotion. No person profits more than the man himself who has been required to prepare for passing an examination; but it is not our business, and we have left railroad officials to attend to their own affairs without our interference. What we are trying to do is to get out a paper that will help men to pass examinations concerning the details of their business. The man who kicks against telling what he knows about a locomotive and train mechanism necessary for the safe handling of a locomotive is a back number.

The Newton Machine Tool Works report they are receiving more orders for cold saw cutting-off machines for steel foundries than any other branch of their work. Among the many orders recently received are two large saws for the Penn Steel Casting Company, and saws for the American Steel Casting Company, and for the Logan Manufacturing Company. With the closing of this year they have shipped about 75 per cent. more machines than during any previous year.

Locomotives and Railways is the name of a new paper which comes to us from John Heywood, Deansgate, Manchester, England. It is Volume 1, No. 1, and is a two-penny monthly. It seems to be well printed and the engravings are good, but it follows closely the lines of *Locomotive Magazine* of our friend F. Moore, of 102A Charing Cross road, W. C., London—too closely to claim any special field.

Pneumatic Tools in England.

Mr. Henry James Kimman, mechanical superintendent of the Standard Pneumatic Tool Company, has just returned from an extensive European tour. While in England he established works at Chippenham, near London, for the manufacture of the "Little Giant" pneumatic tools for the European trade, and installed therein $50,000 worth of the most improved machinery and labor-saving appliances. The plant is now in full operation and turning out tools in large numbers. He states that the opposition to the use of pneumatic tools by labor organizations on the other side of the Atlantic on account of their labor-saving qualities is gradually dying out, and everywhere progressive concerns are installing machines of this description.

They report that their export business has increased with remarkable rapidity during the past year, and the "Little Giant" pneumatic drills, hammers and boring machines are being adopted by some of the largest foundries, shipyards, machine shops, railroad and boiler works and manufactories in Great Britain, France, Germany, Italy, Sweden and Russia. They recently received an order for $25,000 worth of pneumatic tools from a machinery dealer in Holland, and other orders aggregating this amount from the other countries herein enumerated. Domestic business is also increasing.

"The Lake Shore Limited" is nicely described and illustrated in a neat little pamphlet recently issued by the indefatigable Mr. George H. Daniels. Besides describing the novelties, such as the three libraries, private dining rooms, drawing rooms and staterooms, bath room, barber shop, stenographer and typewriter and ladies' waiting maid, there is a detailed itinerary of the trip each way. This tells the passenger just where he is, what place he is passing through and any features of historical interest. It is a novelty that is sure to be appreciated.

Bethlehem Steel Company are distributing a handsome calendar mounted on a card about 12 x 18 inches, with an engraving at the head showing one of their heavy hydraulic forging presses working up a hollow shaft from an ingot of fluid compressed steel. On the twelve monthly sheets appear photogravures of representative forgings produced at the Bethlehem plant, the whole being very effective. The calendars have been sent to the company's correspondents, but we are informed that an application to one of their offices will secure a copy for those who have not already received one.

Brooks Locomotive Works New Catalogue.

This is a finely-printed book of 336 pages (6 x 9 inches), illustrated with good half-tones and handsomely bound in buckram. It contains a brief history of the works, which is very interesting, and shows a fine picture of the founder, Horatio G. Brooks.

There are over 100 half-tones, showing locomotives of about every type, together with their leading dimensions.

In addition to this there is a mass of data concerning tractive power, capacity of different engines, effect of different sizes of wheels and cylinders, resistance of curves, etc. There are also charts of compound cylinder ratios, which are sure to interest draftsmen and designers, as well as students of these engines. We do not know how these can be obtained, but we do know that they are worth paying any reasonable price for, owing to their value as a reference book.

The Hollow Staybolts.

There seems to be some misunderstanding about the Falls Hollow staybolt, as they often receive inquiries as to whether it is hollow clear through, or only in beyond the thickness of the sheet.

These bolts are made from rods about 8 feet long which are *rolled* hollow their entire length and cut off as required, the hole being central in all cases. The diameter of the hole can be varied as desired by the customer from 1/8 inch to 3/4 inch, according to size of the bolt. The average hole is 3-16 inch.

The relative merits of hollow rolled or drilled bolts are viewed differently by different people, the question of cost being the main point in most cases. The Falls Hollow Staybolt Company inform us that they are now able to offer hollow bolts of best charcoal iron at a price which makes it unprofitable to drill them. They also furnish steel staybolts when desired for marine or other service.

How Politicians Perform Railroad Work

Politicians are always ready to undertake any duties that a good salary is attached to, no matter how little they know about the work to be performed. The Louisiana Railroad Commission, from chairman to secretary, know nothing about freight or passenger rates, except in the superficial way in which all business men more or less get cognizant. Mr. De Fuentes is a member of the Cotton Exchange, Mr. Sims a lawyer, Mr. Foster a merchant and planter, and Secretary Barrow, a clerical aide; but the four gentlemen are ignorant of the first principles of rate-making, rate-basing, or rate-equalizations. The subtleties of long and short hauls are as Chinese to them. The commission are capable business men, but they are, without a rate man, like a ship without a rudder. The only thing they can do properly in connection with their appointments is to draw the salary.

Chicago & Eastern Illinois Shops.

The shops of the Chicago & Eastern Illinois Railroad were located at Danville, Ill., some years ago, substantially built of brick with slate roofs. At that time they were up to date in all their appointments. To-day they are still modern, but a good many additions have been made to the buildings and machinery to take care of the heavier engines now in use. One of the latest is a new 65-foot turntable, built by the Detroit Bridge & Iron Works. The roundhouse makes a complete circle, having thirty-two stalls. They are long enough to take in on any pit the longest engine in service and have room to get around it.

At one time the steam pipes leading from the boiler house to the various buildings were underground, most of them laid in conduits, which got filled with water in rainy weather, and it was a matter of difficulty to locate and repair leaks. Laying a new set of pipes through a crowded yard is a serious task. They are now elevated from 18 to 20 feet above the tracks, lagged with asbestos felt, jacketed with sheet iron and painted.

Whether there is any more loss of heat and consequent condensation when above ground than when under ground can be demonstrated by this trial. The roundhouse and all shops are steam heated. In the way of additions to the shop buildings, we noticed a brick pattern house, 30 x 50 feet with a tile roof, strictly fireproof except as to contents.

We fear that patterns cannot be made fireproof during this age of wood. Some day all small patterns will be made of some fireproof substance not affected by dampness or dry weather. Possibly aluminum may be one of the articles used.

The blacksmith shop has an addition which holds six more fires and a new steam hammer. All the bolt-cutting, nut-tapping, wheel-boring machines and axle lathes are in one room.

A new staybolt machine with a lead screw to feed the bolt and dies along, so as to make correct threads, has just been installed. Mr. Lawes, superintendent of motive power, states that this type of machine will thread staybolts that will screw through both sheets of a firebox without binding the threads and straining the staybolts.

Nearly every machine that needs one has an air hoist. Air is used all over the plant and freight repair yards, which are extensive. Some air bulldozers or bending machines are under way. The Leslie fire kindler is used in the engine house. One Rand compressor has been in service for some time, another has lately been installed; the two furnish plenty of air. The shops, roundhouse and yards are now being lit with electric lights.

A new elevated water tank is about ready for use; it is supported by a steel frame. This method of supporting elevated tanks for supplying locomotives with water and at the same time giving a pressure for other purposes is very popular, and justly so.

All the scrap iron of every kind, except rails and frogs, comes to the main shop, where it is sorted over. There are twenty nine bins for the various kinds of wrought iron, cast iron, sheet scrap, steel, brass, etc., very conveniently arranged, so that it has to be handled only once. A miniature pile-driver with a drop of about 12 feet (the weight raised by air) is used to break up castings to get out any wrought iron. It is chiefly used to break up old drawbars to get the yoke and its rivets loose. It does this work much quicker and cheaper than the rivets can be cut and punched out.

The freight power is moderately heavy. Most of the engines are 20 x 26-inch cylinders, with 54-inch drivers, with 200 pounds of steam. One new Pittsburgh compound is on the way, with high-pressure cylinders 21 x 30 inches and low-pressure 32 x 30 inches. These engines have a four-wheel truck and four pair of drivers, 54 inches diameter.

Dunbar packing is used in the pistons. The complete rings are ⅞ inch wide by 1⅛ inches deep. All eccentric cams and straps are of cast iron, with no other material in the bearings, which are very wide; some for the freight engines are 4½ inches across the face of the cam.

This road between Danville and Chicago is comparatively level, the steepest grade being 22 feet to the mile. Sixty loaded cars of coal is the train. The line is double-tracked between Chicago and Danville.

Mr. Lawes goes on record as in favor of the wide firebox extending outside the wheels, especially for the low-wheeled freight engines. He is certain that the limit of length is reached for a box no wider than the frame. More heating surface and more grate surface are needed to give boiler power. Very long fireboxes cannot be economically fired. He has it in mind to try one at the earliest opportunity.

This road has no air-brake instruction car, but the instruction room is very well equipped with a fourteen-car train, tandem triple valves and all styles of both Westinghouse and New York brakes, sectioned and mounted.

About 500 men in all are employed here. A few new freight cars are built, but the bulk of the work is maintaining the passenger and freight equipment. They have a very good plant for repairs and painting passenger cars.

That the locomotive seems to be capable of about anything in the way of pulling is shown by its recent use in laying a cable between Randall's and Ward's Islands, New York. The distance across Bronx Kills is 600 feet, and the new cable weighed about 3 tons. The cable was stretched across Randall's Island in the line of the crossing and 1,000 feet of 1½-inch rope was attached to it, and led to a powerful freight locomotive stationed on the track running across St. Ann's avenue, and this rope was passed over a snatch-block placed on the line. Then the locomotive moved off, and the cable was pulled across in 11 minutes and 33 seconds. The strain on the rope was considerable as the cable pushed through the muddy river bed.

The Union Pacific had at one time a great many locomotives built with Laird guides and cross-head, and in their operation there was no end of trouble from broken piston rods. As these engines go through the shop two bar guides are put on, one above and the other below the axis of the cylinder. This seems to be the best arrangement of guides that could be used, for the cross-head is held central as it ought to be. The plan admits of repairs being quickly made and of perfect adjustment being effected without tedious labor. The Union Pacific people say that the effect of the change is that they do not now have one broken piston rod for ten they had previously. The cross-heads have wrought-iron gibs babbitted.

The superintendent and the chief train dispatcher of the Taunton division of the New York, New Haven & Hartford have been indicted by the Federal Grand Jury at Boston on the charge of unjustly discriminating against a telegraph operator. The charge is that they discharged the man because he belonged to a labor union.

Not a Hill Climber.

"How does the new engine go, Bill?" said the master mechanic as the "841" came in after her first run with a regular train.

"She does perty fair on the level, Mr. Blank, but when she comes to a hill she tries to go under it."

The *Blacksmith and Wheelwright* celebrated its twentieth anniversary by getting out an extra large January issue. It was a very creditable issue, and the editor, Mr. M. T. Richardson, is to be congratulated on his success with the paper.

The Sargent Company are sending out an index to their M. C. B. book of rules and knuckle chart. This should be placed in the book, as it facilitates reference to it and saves more time than one would imagine possible.

The Brady Brass Company, 202 Tenth street, Jersey City, are sending out a calendar which has a splendid engraving of the American eagle and the flag. It is splendidly done, and you can almost hear the eagle give his regulation scream.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII | 95 Liberty Street, New York, March, 1900 | No. 3

Ventilation of Signal Lamps.

In a conversation with a manufacturer and dealer in signal lamps about the sweating on the inside of the lamps which affects the colored lenses, as well as the clear light from a white lens, he put forth some good ideas on this matter of general interest to our readers.

ROGERS ENGINE REBUILT FOR PLANT SYSTEM BY W. E. SYMONS. HAS A RECORD OF MAKING MILES IN 45 SECONDS, WITH EIGHT CARS. ELECTRIC HEADLIGHT, CAB AND RUNNING-BOARD LIGHTS.

The sweating on the inside of the lamp depends directly on the ventilation. The lamp maker is interested in making his lamp as nearly perfect as possible and corrects the faults from time to time as experience and observation show these faults to him. But the means for perfect ventilation which are all right for a tail lamp on a coach in the train shed will not always be satisfactory when running at high speed. In the first case the lamp will get very hot and smoke; in the second it will be so cold that the vapor will condense on the lenses. This condensation varies with the condition of the weather, and if a jacket could be put on the lamp in extreme cold weather and the amount of air supplied when standing still be regulated, possibly the ideal lamp could be devised. Such conditions, however, will never obtain; the lamps must be a standard to suit all conditions.

The grade of oil also has considerable to do with the sweating of the lamp. If the lamp is arranged to burn ordinary kerosene, and a heavier grade, like mineral seal oil, is used, the lamp will not give good service in all weathers. All signal lamps are intended to burn common headlight oil, and not the heavy mineral seal oil. If there is any difference, the heavy oil should be used only in extreme warm weather.

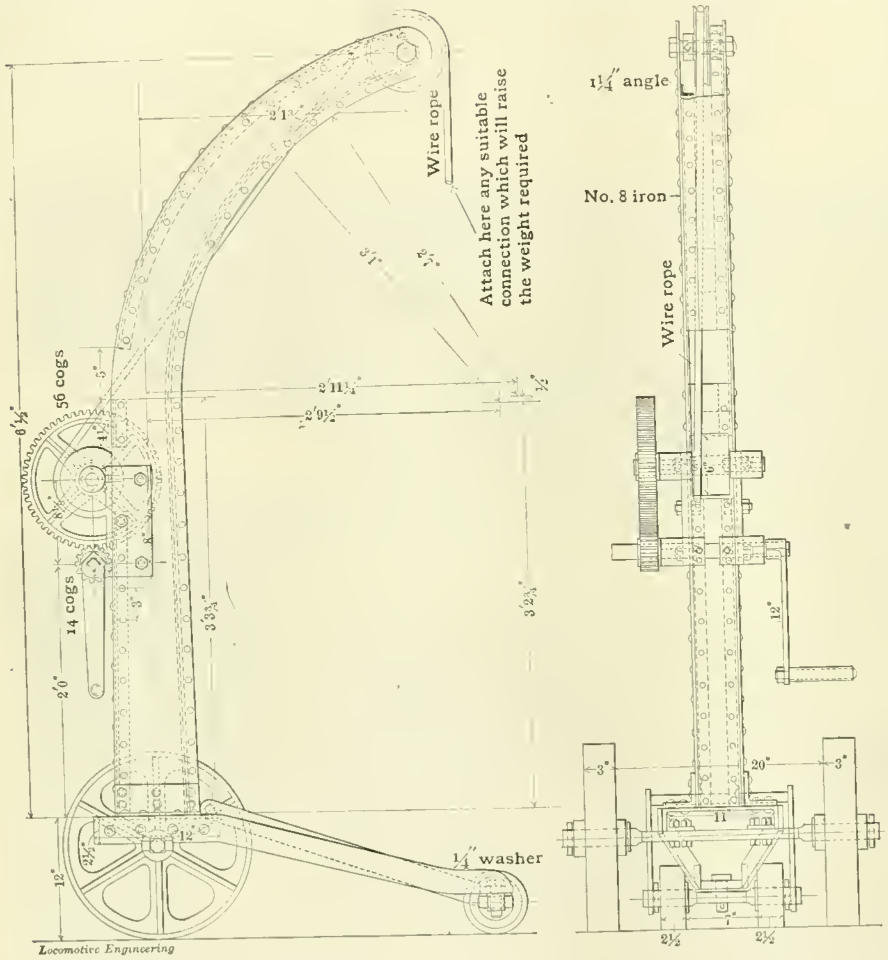
Tail lamps suffer from want of systematic cleaning and adjustment. It is not unusual to see the draft openings closed up partially by a bunch of waste tied around the lamp, sometimes at one place, at other times in another, and the men handling the lamps are not all alike in this respect. If a room and attendant were provided at the terminals where the train men could leave their signal lamps and have them filled with the same grade of oil, properly cleaned and all parts kept in repair, there would be enough better service from the lamps to pay for the expense. Very likely the expense would be less than where each train crew attends to its own set of lamps. This man could attend to other duties if the lamps did not take all of his time. Switch and semaphore signal lamps do not give as much trouble when attended to by the same man regularly, and it is the usual custom to have as many as can be conveniently reached under charge of one man.

Tail lamps, markers and classification signals are vastly more important than those on order boards, semaphores and switches, and should receive the best of care and attention. If a station or switch signal burns dimly or goes out, the absence of a distinct light is a danger signal. But with tail lights the absence of the light from its going out, its dimness or false color, is an invitation for a following train to come ahead at speed, till the headlight shows the form of the caboose and causes a collision certain to be serious. Classification signals are not quite so important, as the standard code requires an audible signal in addition to the colored light when passing another train. By all means let us have tail lamps the best in design, and let them receive the most careful attention.

The Meriden Machine Tool Company, of Meriden, Conn., have issued a 1900 catalogue of their forming lathes for European circulation.

A Portable Shop Derrick.

In the Knoxville roundhouse of the Southern Railway they have a portable derrick which is intended principally for handling steam-chest covers. It is mounted on four wheels, so it is easily moved from one part of the shop to another. The pair of wheels under the frame of the derrick are 14 inches in diameter, while the other pair are small enough to run in under the cylinder which on the cross compounds comes down very close to the floor. There is no pawl and ratchet wheel to hold the weight suspended after raising it, possibly because it was considered safer to let it down. This derrick is close to 7 feet high, and has a wheel-base of 26 inches one way by 24 inches the other, so that it is quite stable. To appreciate its work, one view of it in operation handling a heavy steam chest is enough. It can be moved about and set in position much quicker than an air hoist. The illustration shows how it is constructed.



PORTABLE CRANE FOR STEAM CHEST WORK.

When the Engines Had Names.

An esteemed correspondent of *The Pittsburgh Post* sends the following story about the old-time Panhandle engines: "Along in the fifties somewhere the S. & I. had made a raise of four new engines, three of them passenger engines and one freight engine. They were built at the Lancaster works and were called by their builder 'Brant engines.' There was a great rivalry among the boys as to who would get the new engines, as they were named after prominent men on the road. The James Means, the T. L. Jewett, and I have forgotten the other passenger engine's name; but the freight engine was called Godfrey Heck, after an old Dutch miller at lock 17. He wanted her called after his wife and offered $500 to have her so named, but they would not put a woman's name on an engine, although it was always spoken of as 'she.' Anyhow, the engineer did not have to buy any clothing while he run her, as old Godfrey saw that he had a new suit semi-annually. Elisha Howard was her engineer, and when she whistled the whole Heck family assembled on the doorstep to see her go by.

"It was currently reported and firmly believed that old man Heck gave several evidences of indebtedness for the honor of the name. When, in after years, the company were numbering instead of naming the engines, he threatened to sue if they changed the Godfrey Heck's name to a number, and they didn't, either; she was the Godfrey Heck until she went to the scrap pile. While Lish was running her she took a notion to go down the bank, and as a consequence was somewhat damaged, but not enough to prevent them from running her to the shop."

Trolley Competition.

A paragraph is going the rounds of the press stating that "the new and vigorous management of the New York Central has decided to fight the trolley at every point offering competition along its line." That is rather ridiculous when you come to think it over. What occasion has the old and reliable New York Central got to fight the trolley for anyway? Take, for instance, its Buffalo and Niagara Falls branch. What in the name of common sense has it got to fear from the trolley in the long run? Doesn't it meet the prices of the trolley, and then doesn't it beat the trolley by an hour or more in the trip between the two places? Then hasn't the New York Central a private right of way which precludes, to a large degree, the probability of delays to its trains through killing and maiming people in vehicles en route? Then again, the New York Central has the great advantage of operating roomy and comfortable cars for the accommodation of the traveling public. Fight the trolleys indeed? Why, even the trolley officials themselves use the New York Central between here and Buffalo. Catch any of them going to business between the leading cities on the Niagara frontier in their own cars. Rats!—From the Niagaga Falls *Daily Cataract*.

Rhode Island Locomotives for Fort Worth & Denver Railroad.

The Fort Worth & Denver City Rairoad Company have placed orders with the Rhode Island Locomotive Works, Providence, R. I., for five ten-wheel passenger locomotives, general dimensions as follows: Cylinders 20 x 26 inches; driving wheels 63 inches in diameter, and will weigh 152,000 pounds, of which 118,000 pounds will be on the drivers. The boiler will be of the extended wagon top type, with radial stays and a working steam pressure of 200 pounds. The tubes will be of charcoal iron, Tyler brand, 2 inches in diameter, 13 feet 4 inches long. Firebox 120 inches long, 42 inches wide; double riveted mud ring; tank capacity for water 5,500 gallons, and the coal capacity 10 tons.

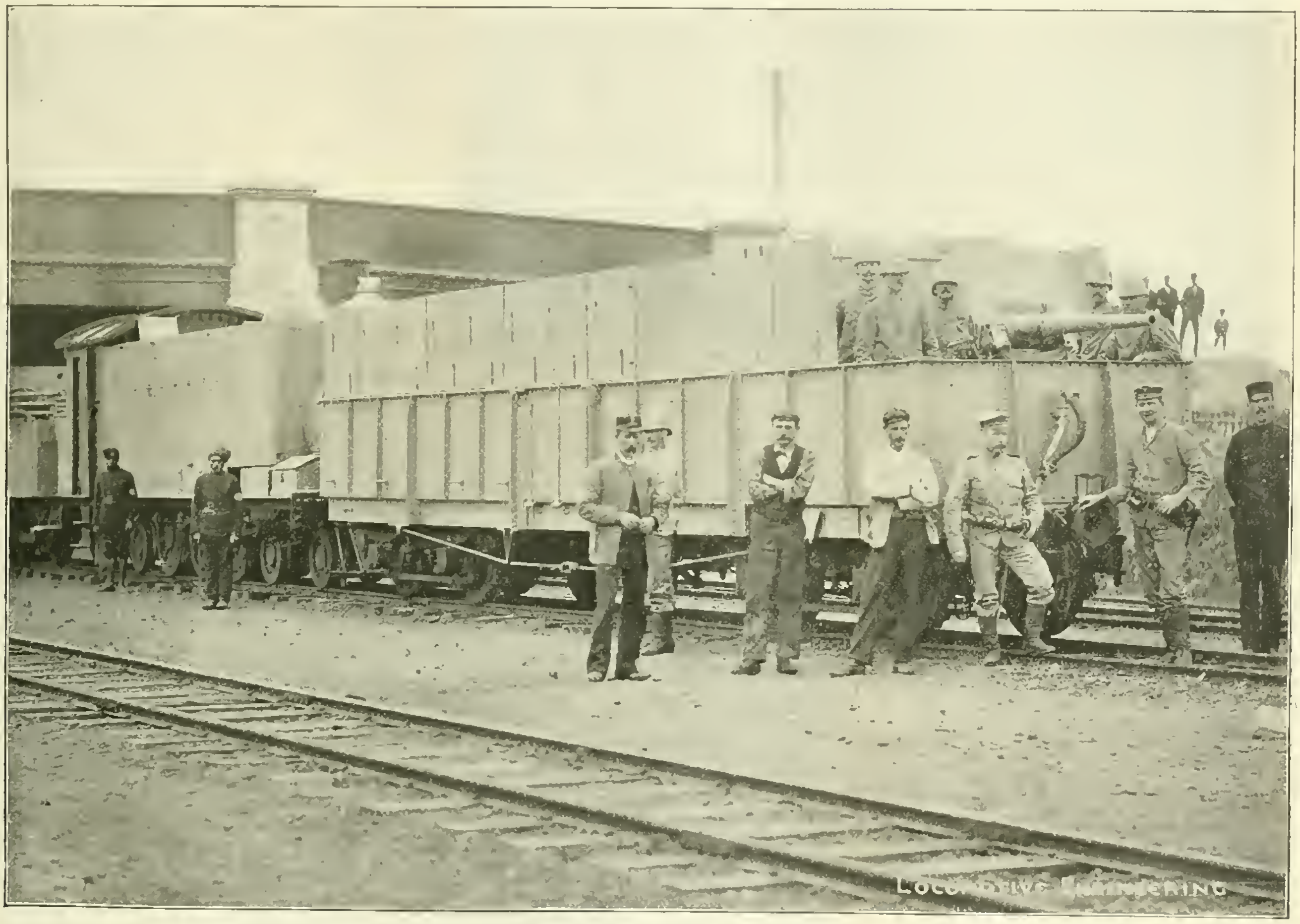
The special equipment will include Ulster special staybolt iron, Little Giant blow-off cocks, Jerome metallic packing on piston rods and valve stems, driving wheel centers cast steel, main driving boxes cast steel, Latrobe steel driving tires, 3½ inches thick, Tiger bronze bearings, Monitor injectors, Nathan triple sight-feed lubricator, Charles Scott Company's springs, Peerless No. 1 babbitt metal, Standard couplers, magnesia section lagging, Leach's sanding device, tender frame 10-inch channel iron, New York air brake for drivers, tender and train with Sargent combination brake shoes.

Railway Scenes in South Africa.

Through the kindness of Messrs. B. P. & G. A. Morris, of Durban, South Africa, subscribers to Locomotive Engineering, we place before our readers a selection of very interesting views of railways in Natal. What will strike the observer in examining the pictures is the close imitation of American forms. The cars are American types, pure and simple, and the rails are spiked to the ties according to our practice. Our correspondent writes:

"We think it will be interesting to your readers, if you care to publish them (the photographs). They convey a good idea of what the country is like. The railroad track is a single one from the Port of Durban to Johannesburg; distance, about 400 miles.

"The armored train consists of four or more freight cars, open, 20-ton bogies, 35 feet long; the locomotive in the center; all armored (see photo) with ¾-inch steel boiler plates, loopholed for rifles. The armored train shown in the large photo is manned by the naval detachment from the H. M. S. 'Terrible.' This locomotive is a double-ender, and was built at the Natal Government Railways Works, Durban."



ARMORED TRAIN LEAVING RAILWAY WORKS, DURBAN. NOTICE LOOPHOLES FOR SHARPSHOOTERS.

Lubrication.

This ever-present subject was discussed at the January meeting of the New York Railroad Club by several of the members. The speaker of the evening was the genial General Miller, of the Galena Oil Company, and he was ably assisted by the others.

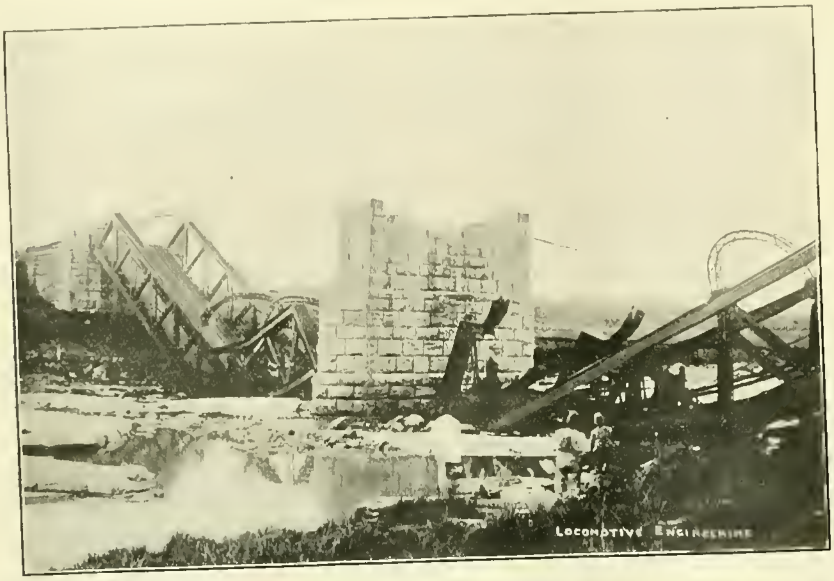
It seemed to be the general opinion that much of the grief due to hot truck bearings could be avoided by the use of less waste in packing the boxes. Most of them agreed that there was generally about one-third too much.

The practice of simply crowding in more waste and not taking out the old from the back end was severely condemned as being the cause of many hot boxes. Instead of this it was advised to have the waste already in the box loosened up all the way back, so as to feed the oil to the journal. When it is allowed to become hard or is jammed, it becomes hard and scrapes the oil off rather than feeds it up.

Mr. Hodges, of the Long Island Railroad, told of a remarkable experience with an elastic fibre waste. The box was packed with 1½ pounds of waste and 9 pints of oil. It ran cool 31,791 miles between June 1st and January 18th, and was not opened in the meantime, being locked purposely.

He did not advocate running boxes without inspection, but this was a special trial which gave almost unheard of results. Long fibre waste was deemed better than short, and attention called to the difference in the way of handling packing by different men.

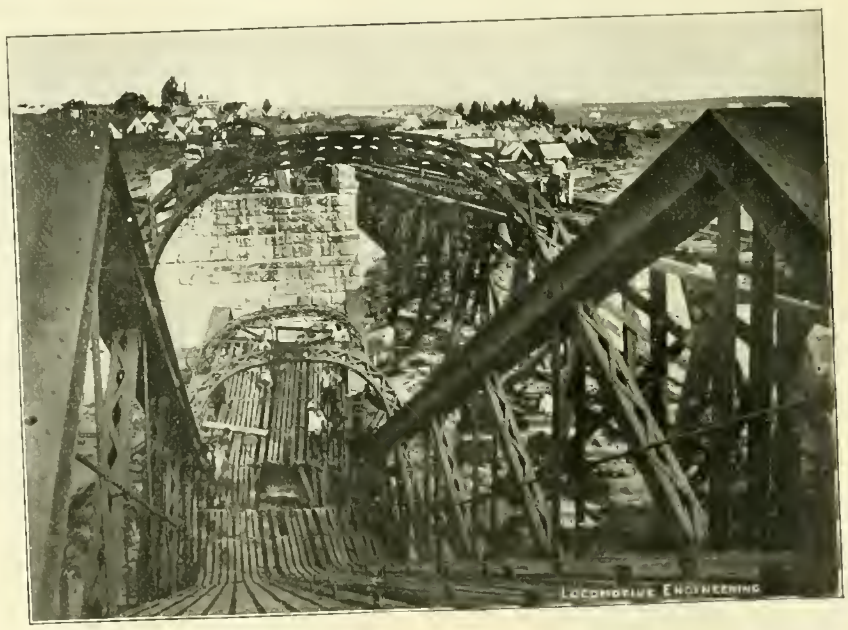
The effect of poor waste was shown to be detrimental, and the use of waste balls, as practiced by some, was not favored.



FRERE BRIDGE, WRECKED BY BOERS.

Mr. McCarthy, of the Galena Oil Company, gave some interesting facts and described a model journal box he had made for showing the effect of different methods of packing boxes.

The contents of a car box were given as from 1¼ to 2½ pounds of waste and from 4½ to 11 pints of oil. These are quite wide limits of variation, but depend on the size of car and the method of packing.



ANOTHER VIEW OF FRERE BRIDGE.

Facing Wedges for Steel Driving Boxes

Steel driving boxes give considerable trouble on account of cutting the cast-iron wedges and shoes, which makes them stick, so that the engine rides hard; for this reason cast-iron wedges cannot be set up as snug against a steel box as against a cast-iron one.

Various methods have been tried to obviate this trouble, which is a serious one. Facing the wedges and shoes with some other metal works very well. On the Chicago & Western Indiana Belt Railway five pockets are cast in the face of the shoe and wedge, ¾ inch wide, ¼ inch deep and 3 inches long, running diagonally across the face of the bearing that comes against the steel box. These pockets are filled with babbitt metal, and the face of the wedge then finished up. The box does not catch on this surface.

On the Detroit, Grand Rapids & Western Railroad the shoes and wedges are faced with brass; the boxes do not stick; but unless the brass is very hard it wears fast and leaves a shoulder near the top and bottom of the box, which must be trued off at intervals, or the box catches on the shoulder.

Rules for Watch Inspection.

The Burlington people do not propose that accidents to trains shall happen through men carrying inferior watches. New rules just issued provide that hereafter each watch must be at least a "nickel, seventeen jewels, adjusted to temperature, isochronism and positions, with patent regulator and Brequet hairspring," and must not vary to exceed thirty seconds per week. Heretofore a fifteen-jewel movement has sufficed. Beginning on February 1, each watch must be taken to a designated inspector at the nearest division point, and there thoroughly gone over once each quarter, during the first week of February, May, August and November. If found up to the required standard, a card certifying to this fact and thoroughly identifying the watch will be given the owner. This card must constantly be carried with the watch. Each man with a watch must go to the inspector once each week and there register and have the variations of his watch noted by the inspector, and have it reset to the correct time if there is any variation. The rules forbid an employé setting his watch or in any way changing its movements unless it shall have run down. Whenever a watch is found out of order and has to be left for repairs, a substitute watch may be furnished with the approval of the inspector, but must be accompanied by a special repair card. Inspectors will have for sale the watches of the required standard at lowest figure, and are to make necessary repairs to watches at reasonable rates, but it is not compulsory that employés buy their watches or have repairs made by the inspectors. All must meet the inspector's approval, however.

Smokeless Coal.

The Chicago & Erie use Pocahontas coal from the Virginia mines on their passenger engines, from Marion, Ohio, to Chicago, and have some very good reasons for using this coal in the Indiana coal district, where one would think that the home product would have the preference. The Indiana coal is much cheaper as regards first cost and that of transportation from the mines to the coal chutes; but it does not show the economy in other lines that the Pocahontas coal does.

The smokeless coal makes no smoke that can be seen from the coaches when properly fired. There are very few cinders, so the train runs very clean and comfortable for the passengers. The engines steam free with it, which they do not when using the Indiana product. A larger exhaust tip is used; this in turn reduces the back pressure, so the engines make better time. The run of 269 miles is made with one tender of coal, and does away with one stop. There are very few cinders or ashes in the pan, so that that does not need cleaning out on the trip, which with the Indiana coal caused considerable delay.

Of course, it is not all on the side of smokeless coal. The fire must be kept very thin and even; this heats the grates more than a thick fire with a generous thickness of cinders lying on them. After the firemen get used to the coal it gives no trouble.

Using coal of this kind is an easy solution of the smoke problem in passenger service into Chicago.

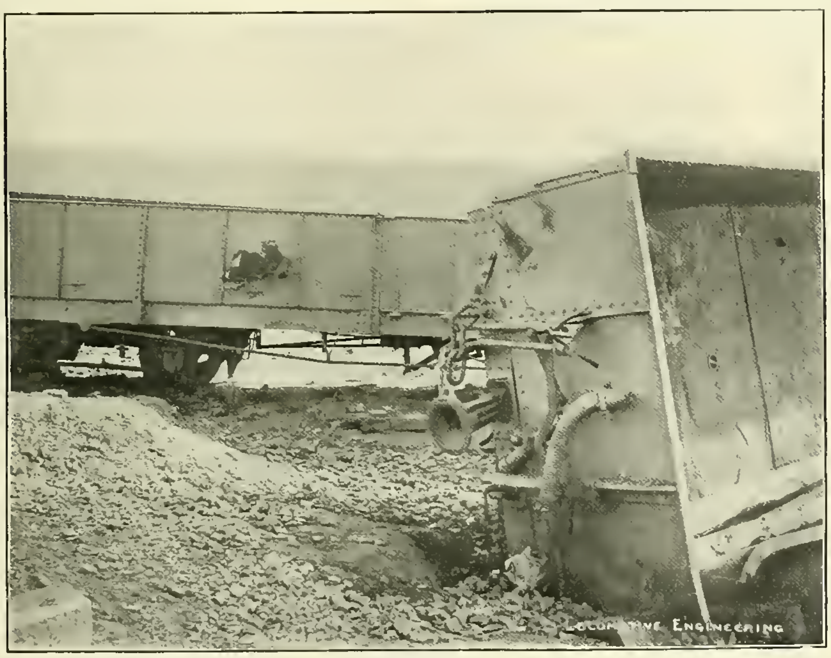
The Staybolt Question.

Mr. F. W. Johnstone, superintendent of motive power of the Mexican Central Railroad, in an article on flexible staybolts in the *American Engineer and Railroad Journal* for January, states that it sometimes costs $10 apiece to replace broken staybolts in certain parts of the boiler, where other parts of the machine have to be taken down in order to get at the defective bolts. There is no doubt that he is correct in his estimate of this expense, and it is an object lesson calling for an arrangement of the other parts that will allow all the bolts to be easily reached. With a firebox between the frames this will be quite a proposition, but when the firebox is above the frames there is a chance for the skillful designer to make accessibility of staybolts one of the advantages of his design.

Mr. Robert Quayle, superintendent of motive power of the Chicago & Northwestern Railway, stated in the same number that "the whole secret of the staybolt question is the larger water space. We have proved beyond a doubt that by increasing the width of the water space, and consequently the length of staybolts, we have increased their period of usefulness about thirteen times, without the slightest change in the material."

In regard to a larger water space, so as to allow a longer staybolt, we have in mind an engine in which this question was tested. It was a 17 x 24-inch cylinder passenger engine, with a boiler built of modern design, 54-inch shell, 210 flues, a deep firebox and a high wagon top with steam dome on that, steam pressure 160 pounds. When it became necessary to replace the firebox on account of the side sheets cracking near the fire line, a box was put in 4 inches narrower at the top, which made the top rows of staybolts 2 inches longer. Very little trouble has shown up since, and the boiler has better steaming power, no doubt due to a better circulation of water to the side sheets.

FIRST TRAIN OVER TEMPORARY TRESTLE.



TWO CARS THAT WERE WRECKED BY BOERS. THE LOCOMOTIVE GOT AWAY SAFELY.

Another cause of broken staybolts that is observed by enginemen is the strain put on them by the twisting strain on the shell of the boiler when the engines are working hard. It is not unusual to find leaky staybolts in the top row of firebox stays, just under the belly of the boiler. When the engines are working hard, the hot water will fly out around the staybolt and over the eccentrics and driving boxes, but when the engine is standing still the amount of water coming out there is so small that a boiler repair man looks at it as of small moment.

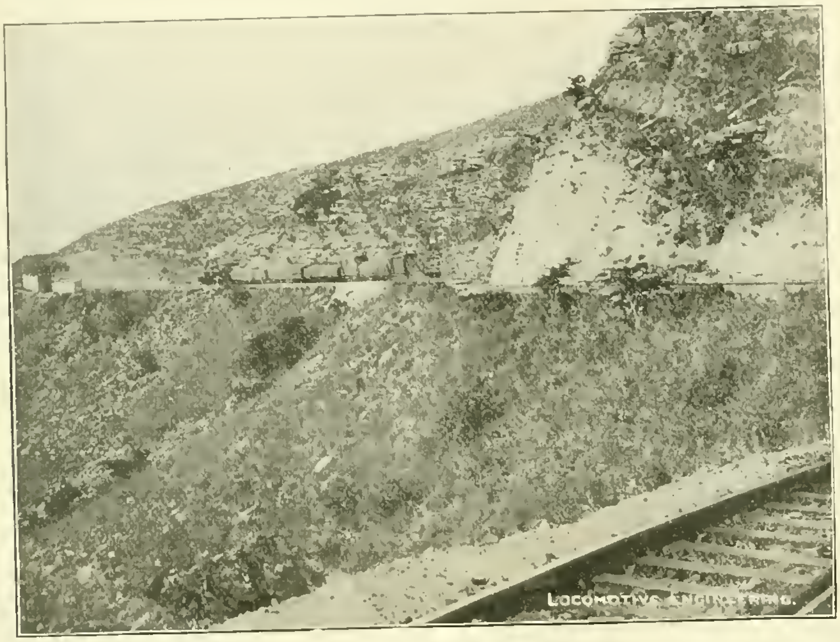
Another instance to which the writer was a witness was a staybolt in the side of the firebox near the top row, which leaked so badly through the telltale hole when the engine was working hard that the side of the cab was obscured by a cloud of steam, but when the engine was standing still at the station the amount of water coming out was insignificant. An increase or decrease of steam pressure made no difference in the matter.

This goes to prove that the outside shell of the boiler pulls away from the firebox sheet enough to cause the defective bolts to leak, and if this takes place at one time it will at another.

Anyone who has been on an engine and seen the frame springing and the engines rocking the boiler around when working with full power will agree with the idea that an additional strain is put on the boiler shell.

When an engine is reversed this action is shown very plainly if at any considerable speed.

Whether strengthening the frames will take this strain off the boiler shell remains to be proved, but it certainly looks as if it would.



BOTHAS HILL, NATAL.

AMAJUBA HILL, NATAL.

Notes on the L. & N.

On a recent trip through the South, part of which was over the Louisville & Nashville Railroad, quite a few improvements and objects of interest were noted.

At Louisville the main shops were very busy. Mr. Leeds has just put in service with engine No. 250 a new type of tender truck for heavy-capacity tenders holding 5,000 gallons of water and a large supply of coal. There are four semi-elliptic springs in each truck with the ends supported by swinging hangers, which takes off the wear of the ends of springs in the pockets; on these springs the truck bolster rests. This tender is said to ride very easy and steady. The tender frame has two body truss rods running under a central needle beam, similar to freight cars.

At Nashville there are two enginehouses with the necessary repair shops, one for each division. These two plants are located a considerable distance apart, but they are to be consolidated. A large new roundhouse of a permanent character was going up in the terminal yards not far from the new Union station. Very likely it is finished and occupied by the time this meets the eyes of our readers.

The new shops at Paris, Ky., are also under way. They consist of a machine shop, 90 x 120 feet; a blacksmith shop, 70 x 100 feet; the boiler and tender shop, set close together, each 65 x 90 feet. The wood mill is 70 x 100 feet, two stories high. The roundhouse is finished. About 125 men will be employed here.

At New Decatur, Ala., there is a very fine plant in charge of Master Mechanic Beckert, who has something over 1,000 men at work. There are twelve pits in the erecting shop, two of which were in use for boiler work. The water south of here is of such a character that flues have to be changed after four or five months' service. The shops are being enlarged yearly, both in the size of the buildings and the amount of machinery, some twelve or fourteen additional machines having been put in the machine shop alone. Overhead cranes and run-ways for air hoists to shift heavy work to and from the machines are put up. Air hoists are plenty everywhere. Instead of running the big main engine and shafting when working a few machines at night, the machines likely to be needed are grouped together and an independent engine is used to run them at night. The shops are lit with electric lights. One of the three large steam hammers in the blacksmith shop was at work bending arch bars for freight car trucks. One end was bent with formers (one of which was fastened to the hammer head) and the bolt holes punched. The bar was then turned around and the other end bent and punched. The arrangement of gages, etc., to secure accuracy was very good. The bar was finished at one heat in about 1½ minutes. The boiler shop has had an extension of 80 feet; the foundry 40 feet, and there are a new core room and drying room.

In addition to the repair work on the freight equipment, which is extensive, and includes the air-brake equipment on all cars not so equipped, they are building over 100 new cars per month. There is shed room for forty-two cars at one time. Most of the light repairs are made in the repair yard, which is very large. The car work here is heavy.

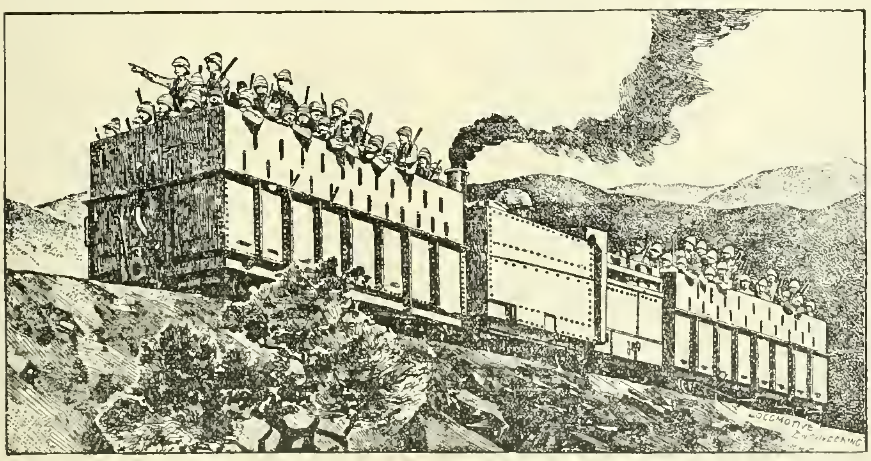
At Howell shop, which is in charge of Master Mechanic Walsh, in addition to the large number of cars repaired, they are putting air brakes on about thirty cars per day. In the machine shop they have just put in an annunciator connecting the tool-room with various points in the shop. A workman can "press the button" and call a messenger boy from the tool-room, give him a check, and have the tool he wants brought to his machine. There is also a speaking tube running to the remote part of the shop, by which the tool-room can be called up. This saves considerable of the workman's time.

The Louisville & Nashville Railroad

have a plan for making eccentric cams and straps of a standard size and design which could be copied with good results by some others. The axles are of as few standard sizes as is possible. The cams are first bored out for this exact size and slotted for the keyway. They are then put on a mandrel. With the centers laid out with the proper throw for this particular type of cam and the outside turned off to a standard size which makes all the cams of this type interchangeable, a new one will go right on the axle and have the same throw and lead the old one did. The straps are also a standard. All the cams and straps are cast at one foundry, of the same grade of iron for the cams, and the proper quality of iron in the straps to give good service. The straps have a piece of brass inset into each half. This brass is cast in a recess of the strap. The strap is then finished in a lathe.

ARMORED TRAIN THAT WAS WRECKED BY BOERS.

FREIGHT TRAINS IN NATAL.



GENERAL FRENCH'S ARMORED TRAIN LOOKING FOR BOERS. TAKEN FROM "BROOKLYN CITIZEN."

The bearing on face of cam is liberal, which is the best guarantee against heating.

The new G4 and G4A engines of the Pennsylvania Railroad are nice looking machines, with their practically straight boilers and neat lines generally. The former have 72 and the latter 62-inch wheels, and both carry 225 pounds boiler pressure. They are being built at both the Juniata shop and Baldwin Locomotive Works.

An Examination Question.

BY C. B. CONGER.

One of the boys in the primary class writes that the master mechanic asked him a hard question the other day, and he would like a start, so that he can answer it. The question was, "Follow the course of the water from its entrance into the tender till it comes out at the top of the stack, and give such information as you can as to what force causes it to pass along, what parts of the boiler and engines it passes through and what operations it can perform on the trip."

That is a pretty large question, you think? Yes, it is, if you follow it up, and it deals more with the construction of the machine and the changing of water into steam than with the handling of the train and engine. But the construction of a locomotive is of some importance to a young man learning the business, and the changes which take place in water when passing through are of interest also. One of the objects of LOCOMOTIVE ENGINEERING is to furnish its readers with information that will help them out when they are asked hard questions. Some master mechanics ask these hard questions to set the men thinking, with the hope that mental exercise will make them brighter in the long run.

In the first place, it is usually the force of gravity that causes the water to flow from the tub through the stand pipe into the tender; we need not explain that. When it is in the tender, its next move on its trip to the stack is towards the injector. If a non-lifting injector is used, the force of gravity keeps the injector supplied. If a lifting injector is in service, the pressure of the atmosphere raises the water through the supply pipe up to the injector.

If the atmosphere cannot get into the water cistern of the tender as fast as the water flows out, in a very short time there will be no way for it to deliver its pressure on the water. Look out for this, especially in the winter time. Water splashes up against the top and may freeze over the air holes, in which case water will not be lifted up to the injector. When the water once reaches the injector and is operated on by the steam from the boiler, it is forced into the delivery pipe and passes on into the boiler. Water that goes out of the overflow will be lost, so far as any immediate use in the boiler is concerned.

The steam from the boiler combines with the water when passing through the injector and adds to its volume the amount of water formed from the condensed steam, as well as heating it considerably. This expands the water, so there is a larger volume of water passing away from an injector than comes into it from the tender.

The water enters the boiler near the smokebox end for two reasons—first, to have it come into the boiler as far away from the hottest part as possible, so that its temperature may be raised gradually as it flows towards the firebox, and, second, so that the cooler feed water will surround the flues, where the products of combustion leave the boiler, and thus absorb a greater proportion of heat from the gases. This is the theory, but the circulation of water in a locomotive boiler is so rapid, that it does not stay long in any one place. This rapid circulation is the effect of the heat absorbed by the water; the water rises along the hot firebox sheets and up between the flues. To take the place of the water which rises, some must flow in from somewhere else in the boiler; it comes down next the outside shell, where there is no heat. If the water-spaces are so narrow between the two sheets that water cannot flow down next the outside sheet and up next the firebox sheet, this boiler will not steam freely, neither will it carry water well when the engines are working steam. A free circulation of water in a boiler is just as essential for a good steamer as large heating surfaces.

Heat taken up by the water changes its nature. Water is a liquid whose particles can move freely among each other, but it has no elasticity; it cannot expand into a larger volume and be compressed into a smaller one. About the only way we can get any power out of water, without changing it into steam, is to avail ourselves of the force of gravity. When water absorbs heat, it expands more or less, according to the amount of heat taken up, until it reaches the temperature at which it becomes steam, when it changes its nature to an elastic fluid or vapor. The specific gravity of steam is much less than that of water, so that as soon as steam is formed, it begins to rise through the water; this also increases the rapidity of the circulation upward.

When the steam reaches the surface of the water it carries some of the water up with it like a film or bubble; if the steam passes away from the water very fast it carries some of this water along in the form of a spray. If at the water line of the boiler there is a large surface for the steam to pass away from, the steam will be much drier than from a small surface. When you fill a locomotive boiler nearly to the top, the surface of the water not only gets closer to the throttle valve opening, but the surface is reduced in extent and priming results so that some of the water passes out of the boiler to the engines in a solid state. If it is not afterwards turned into steam it is lost. When the steam passes through the throttle valve it goes into the dry pipe in the top of the boiler, which extends through the flue sheet into the smoke arch. At that point, as there are two separate engines to supply with steam, the dry pipe branches into two steam pipes, one leading to each steam chest. These steam pipes are exposed in the smoke arch to the heat of the gases which come through the flues from the firebox. This heat can turn into steam any water which may pass over. However, these steam pipes, being made of cast iron and thick enough to stand the wear of cinders striking them, do not transmit heat as rapidly as thinner sheets, like the sides of the firebox will. Steam, when it leaves the water in a dry state, is called "saturated steam;" if it is afterward heated to a higher temperature it is then called "superheated steam," and is still more elastic.

When the steam finally arrives in the steam chests it is ready for distribution to the cylinders and there performs the work for which all this change from water to steam has been made.

It has been said that heat is force, and with a proper agent can produce motion. If we follow up that definition, the force of the heat which is stored up in the coal is changed into motion through the agency of the water and steam, and finally the engines, and thus made available for commercial purposes. There is so much loss in the changes from the coal till it is finally shown up in the pull on the draw-bar, that we only get a very small percentage of the total power stored up in the coal. The distribution of the steam is effected by a valve in the steam chest, which is operated by the engine itself, and on the proper distribution of the steam the efficiency of the locomotive depends. We cannot take time to explain about that now. When the valve in the steam chest opens the port leading to the end of the cylinder, the elastic force of the steam causes it to flow into the cylinder and push against the piston, which in turn delivers the force to the crank pin in the main driver. From there it goes to the other drivers. By their adhesion or bite on the rail the engine is moved along. In a stationary engine the belt which goes around the driving wheel moves in relation to the fixed parts like the earth; with a locomotive the rail is the belt, but it is fixed, and the drive wheel moves over the rail.

It is the universal practice to work steam expansively in the cylinders of a locomotive. With this method we use the direct pressure of the steam from the boiler at first, then cut off the supply of boiler steam and allow that already in the cylinder to expand and exert its expansive force down to a much lower point.

When steam expands its temperature is reduced, and if the temperature is reduced below the boiling point it will return to water again, or condense.

Considerable of the steam is condensed on the inside surface of the cylinder, both from the expansion and from the loss of heat which passes through the walls of the cylinder into the outside air. Radiation of heat also takes place from all the passages that the steam passes into or through, after leaving the steam pipe in the smoke arch. So you see that some of the water that goes into the tender may pass out of the boiler in the form of spray with the steam, and another portion change from steam to water in the cylinders.

After we have once changed water into steam, if we allow it to change back before we have made use of all the energy that is stored in it, we lose all the heat that it took to make the change.

The steam and water—if there is any water—must be got out of the cylinder before the piston starts on its return stroke or we will not get the full effect of the steam to be admitted to the other side of the piston. The same valve which alternately admits live steam to either end of the cylinder is also used to exhaust the steam. The live steam gets into the steam ports to the cylinder past the end of the valve, the exhaust steam comes out through the same port from the cylinder, passes up through a cavity in this same valve, and reaches the exhaust port, then passes to the exhaust pipe in the smoke arch. The steam has now finished its work of moving the engines, but it has not done all the work cut out for it to do. A locomotive boiler has such a small grate surface to burn coal on that the draft must be very fierce to supply air for the amount of coal burned. Natural draft will not do this, especially with the short stacks which must be used on locomotives; so the exhaust steam is used to create an artificial draft. To do this it must have considerable pressure back of it when it passes up through the exhaust tip and out of the stack. This back pressure represents just so much of the power of the steam used in making steam, but we can produce a draft that way cheaper than any other, provided we do not get too much back pressure. As your question did not specify the steam and water that did not come out of the stack, we will not touch on what goes to the injectors, the air pump, the steam heat system, the electric headlight, the blower, and other places where the cylinders do not get the advantage of it.

Hard on Worcester.

"Had kind of a funny experience in Worcester the other night," said a friend who dropped in for a little visit last week. "It was about 6 o'clock, and I was tired and hungry, after a busy day, so I asked a policeman what hotel I better go to.

"He looked rather astonished and said, 'Have you *got* to stay here over night?' with a double emphasis on the 'got.' 'Course if you've got to stay, you better go to the ——; but if you can go to either Boston or Springfield you'll be happier to-morrow morning.' And he wasn't far wrong, either—for I thought I'd try it one night and see for myself."

General Correspondence.

All letters in this department must have name of author attached.

Bartlett's Telescope.

Nearly all men of active minds have some sort of a hobby they like to ride. The hobby which Mr. L. Bartlett, master mechanic of the Missouri Pacific, amuses himself with is making telescopes and other instruments that require extraordinary fine workmanship.

During a recent visit to St. Louis we were shown by Mr. Bartlett the telescope which we illustrate. The workmanship on it is as good as if it had come from the hands of a regular mathematical instrument maker. In sending a photograph, Mr. Bartlett says:

"I send to you by mail to-day a photograph of the instrument in the observatory at my residence. I have felt some little hesitancy in doing this, because I have never been a seeker of notoriety; but as a picture of this instrument might indicate to the balance of our railroad friends that railroad men sometimes have fads or hobbies disconnected from their legitimate line of business, and they might also be glad to know who such gentlemen are, and in visiting different cities, should they be interested in some of these lines, they would have an opportunity of calling and witnessing some of the productions of amateurs. It was at your solicitation that I had a copy of the photograph made, and send same to you. I do not think that I would have done it voluntarily. You saw the instrument and the surroundings, and possibly can better describe what you saw than I.

"Suffice to say, in a general way, that the building is square, made of wood in the cheapest possible form, covered with iron upon the outside, and the roof is run off on rollers. The track upon which the roof runs off has an inclination of about 6 inches in 12 feet, and the roof is pulled back in position by a rope going over a sleeve. The instrument is set upon a brick pier and the columns bolted securely thereto. The telescope tube is driven by clockwork, which is not shown in the photograph, as it was taken before the clockwork was applied. The right ascension and declination circles are made of aluminum, the graduation being made upon this metal, and as the metal does not tarnish under any circumstances, it makes a most excellent material for this service.

"The entire instrument was built by the undersigned, even to the grinding of the lenses composing the object glass, and I might say in this connection that in the figuring of object lenses for telescopes, the refinement of mechanics is developed to the highest degree. The errors of curvature amounting to anywhere from twenty to fifty or more thousandths of an inch have to be taken into consideration, and instruments for measuring these quantities are used. These figures may seem extravagant to some of our friends in the locomotive business, but I assure you they are not extravagant to the optician. The heat from the finger held for a very short time upon the surface of a piece of glass will cause a little hill to be raised by the expansion of the glass, and this hill can be readily measured. This gives some idea of the delicacy with which the curves of object lenses have to be produced. In fact, opticians sometimes cease work entirely for some hours upon lenses, in order that they may accommodate themselves to an equalized temperature, so that the figure can be more accurately determined. L. BARTLETT, D. M. M."

A MASTER MECHANIC AND HIS TELESCOPE.

Old Ties for Kindling Fires.

I have read the article in the February paper describing various ways of breaking up old ties so that the wood can be used for kindling fires. The appliances described are no doubt very ingenious and do the chopping at small expense, but in my opinion it is all misplaced ingenuity. I never knew of a place where old ties were used to kindle locomotive fires that it would not have paid better to throw the ties away and buy cord-wood. There are always spikes left in the wood that jam the grates so that they cannot be shaken, and then no end of grief ensues. Burned grates and being compelled to stop short of a division point to clean the fire, cause expense that would cover the price of a great deal of good wood.

It seems to me also that the practice of kindling fires with wood is about as antiquated as using pumps for feeding and steam chest cups for lubricating the valves. Have the people using wood never heard of oil fire-kindlers?

JOHN ROBINSON.

Chicago, Ill.

Delaware Division of Erie a Training School for Officials.

I see in the LOCOMOTIVE ENGINEERING that you expect your agents to give an account of changes made on their roads when it is convenient for them to do so. As a matter of course, it is to help the journal along, as every good agent should do. Now, as there have been a good many changes made on my division (Delaware) of the Erie Railroad during my time—thirty-three years—I thought perhaps it would be of interest to bunch them all together and send them to you.

The peculiar coincidence about this Delaware division is that, as a general thing, when there is a general officer needed the call is made on this division. I will commence back in 1865: The Erie wanted a general superintendent. Mr. H. Riddle, who was division superintendent, was promoted from Delaware division, Mr. C. W. Douglas succeeding as division superintendent. He (Douglas) remained as superintendent until 1868, when the Ontario & Western, New Jersey Midland and Greenwood Lake railroads were built and consolidated. They wanted a general superintendent, and called on Mr. Douglas and he accepted the position. When he took charge of this road he wanted a good chief train dispatcher. He called on Mr. F. S. Gannon, who is now vice-président and general manager of the great Southern system. Mr. G. S. Reddington succeeded Mr. Douglas, and after his death Mr. B. Thomas was promoted from train master to superintendent of Delaware division, in 1875, and continued until 1880, when he was promoted to superintendent of transportation of the Erie. He is now general manager of the Western Indiana & Belt Line of Chicago.

Mr. Thomas was succeeded by Charles Wilson, who was superintendent of Delaware division a short time, and resigned to go on the Cincinnati, Hamilton & Dayton Railroad as superintendent, and afterwards was First Assistant Postmaster General. Mr. W. J. Murphy took his place as superintendent of Delaware division in 1882, and he remained here until 1884, when he was promoted to take charge of Buffalo division of the Erie Railroad, Mr. Edgar Van Etten taking his place as superintendent of Delaware division, and when Mr. B. Thomas resigned the general superintendency of the Erie, to go West, W. J. Murphy was promoted to general superintendent of that road. He is now general manager of the Queen & Crescent Railroad, and Mr. E. Van Etten, who succeeded him on the Delaware division and afterwards on the Buffalo division, is general superintendent of the great New York Central system.

W. H. Starr took charge of the Delaware division after Mr. Van Etten took the Buffalo division, and remained superintendent but a short time—about two years—when he was promoted to superintendent of transportation of the Erie. Then Mr. W. L. Derr, being roadmaster on the Delaware division, was promoted to superintendent, and remained superintendent for nine years, longer than any superintendent that preceded him. When he was promoted to the Susquehanna division, about one year ago, Mr. G. A. Thompson, of the Rochester division, was promoted to the superintendency of Delaware division, and the first of this year (1900) he was promoted to superintendent of transportation of the whole Erie system, Mr. W. H. Barrett, of Rochester division, succeeding him.

The Delaware division for a long time has been called the Bouquet division. I suppose it is because its graceful bends embrace such a great variety of flowers and evergreens. It could with propriety be called the College division of the Erie, as most all the promotions to the general offices, with a very few exceptions, have come from the Delaware division, and there is a greater number of officers holding high positions on other roads that came off the Delaware division than any other part of the whole system.

Port Jervis, N. Y. A. J. O'HARA.

Figuring Schedule Time.

BY EUGENE M'AULIFFE.

When called before the trainmaster to pass examination on time-card rules, the average man, whether it is the fireman seeking promotion or the engineer just entering the service, glides along smoothly until asked to figure time. By that I mean to add given number of minutes to the schedule of some certain train; as, for example, "No. 1 will run 50 minutes late, Bagdad to Cobul." Most of the men who fail in this very valuable and necessary exercise start off correctly, but at the third or fourth station err, and when called to begin over, get nervous and make a poor showing.

A canvass of the methods employed by the men will show almost as many ways as there are men—some using their watch, either by direct consulation or in the mind's eye; others finding a starting point and using that as a sort of base meridian, adding the running time between stations as they move along. The few mistakes made in actual practice can be credited to the margin usually given, as well as the fact that the process is worked over several times. The simplest way to add time is that of adding the hours to the hours, the minutes to the minutes, and then reducing back just as we are taught in our primary arithmetic. For example: Schedule time is 4.12 P. M. plus 50 minutes equals 4 o'clock and 62 minutes, or 5.02 P. M. Again, time 4.19 P. M. plus 50 minutes equals 4 o'clock and 69 minutes, or 5.09 P. M. Again, where the time to be added is 2 hours and 45 minutes; schedule time 7.46 P. M.; equal to 9 o'clock and 91 minutes, or 10.31 P. M. With a little practice this method will prove itself far ahead of the watch dial and index finger methods used, and will enable enginemen to pass this part of their examination with credit.

Wherever suggested to officials and despatchers, the plan has always met with approval and endorsement.

Springfield, Mo.

Consolidations vs. Mastodons.

The increasing number of mastodon or twelve-wheel engines brings up the old question of the weight carried by trucks, and a case in recent practice gives a good basis for comparison. The Illinois Central Railroad has been ordering heavy locomotives of both these types, and a little study of both is interesting.

They are both 23 by 30-inch cylinders, with 57-inch drivers and 210 pounds of steam, and have a draw-bar pull of nearly 50,000 pounds.

The consolidation weighs 218,000 pounds, of which 198,000 pounds are on the drivers. The mastodon weighs 232,200 pounds, with only 193,200 pounds on the drivers.

As the tractive power depends solely on the weight on drivers, and the consolidation has 4,800 pounds more on the drivers, the advantage as to pulling without slipping lies with that engine.

The consolidation carries 20,000 pounds on her pony truck, against 40,000 pounds on the full truck of the mastodon, so the weight on each truck wheel is the same in both cases.

There is, however, an extra weight of 14,200 pounds which are not available for adhesion and seem to be dead weight to be carried by the mastodon engine. Where does the advantage come in, unless, as some claim, the mastodon is easier on track, on account of the full truck as against the pony truck. The ratio of adhesion to tractive power is 3.96 to 1 for the consolidation and 3.86 to 1 for the mastodon.

Taking the case of the consolidation for the Union Railroad built by Pittsburgh a little over a year ago, and we have cylinders 23 x 32. The steam pressure was 200 pounds, and, as given in your issue of November, 1898, the tractive power was 53,293 pounds. The total weight was 230,-

000 pounds, of which 208,000 was on the drivers. This has a ratio of 3.92.

Assuming the pony truck to be all right, especially at the speeds used in freight service, it seems as though the consolidation has the advantage every way you look at it, unless it is that the mastodons have all the extra weight in boiler. The same weight of engine gives more adhesion in the consolidation, and it will stand a larger cylinder (more tractive power), as in the case of the Pittsburgh just cited.

If our tracks were straight instead of all curves, as on some roads, the method of Russia and other countries, of having all the weight on drivers, where it was effective, would be just the thing. As we must have a truck, why not have just as little as possible. R. E. MARKS.

Camden, N. J.

Brick Arches.

In the January number of your esteemed journal, page 38, there appears an article by M. D. Corbus on the question, "Does the Brick Arch Cause Leaky Flues?" and you ask an expression of opinion from those who have had experience with the brick arch.

Without laying claim to a place among the latter class, I would ask the liberty of saying a few words on the question. What causes flues to leak? Is it not a too rapid expansion and contraction of the metals of the flue-sheet and flues? Then will the brick arch cause this expansion and contraction? Just consider the question for a moment. We have an engine with a brick arch; the engine is fired up and gradually heated to the working point, the heat of the firebox probably being between 2,000 and 2,500 degrees. Every particle of the solid mass of the brick arch also becomes heated to this enormous temperature, and will hold its heat for a considerable time after the fire has been knocked out of the engine. Now this brick arch, representing an almost fixed number of heat units, is placed within from 4 to 6 inches of the flues and flue sheet. Is there anything about this that is likely to cause an undue variation in the temperatures of either? Surely not; and yet someone will ask, "Then why is it that an engine that has a good set of flues is so liable to give trouble from leaking if equipped with a brick arch?" The reason is that in all probability the man firing the engine never put coal under an arch before, and as a result the fire is not maintained under the flues as it should be, quite frequently getting into such a condition that cold air is drawn rapidly through the grates and up through the flues. The flow may last but a few seconds, still long enough to considerably reduce the temperature of the metals. It is then cut off by the application of a shovelful of green coal when the great almost permanent heat of the arch will cause the temperature to rise much more rapidly than would be the case if you waited for the coal to ignite, and the heat of the fire cause the change. This, being repeated from time to time, starts the flues to leak; the engine is brought in, the arch is knocked out and condemned, when the trouble was not the arch, but the system that put it there under such conditions.

The trouble is that there is too great a tendency towards making experiments and condemning the results without a fair trial. If you take an engine that is steaming poorly and equip her with an arch, then start her out on the road with a fireman that never saw an arch before, the chances are that when she comes back the man running her will report that she has done worse than ever; but if you take an engine that is in good condition, steaming well and in every way giving satisfaction, equip this engine with an arch, put a fireman on her that understands firing under an arch, and the almost certain result will be a still further improvement in steaming qualities, a decided improvement in the fuel account and a longer life for the flue sheet and flues. Still if brick arches are to be successful on any system, they must be put in all the engines, so that all the men will know how to fire an engine with them. Every fireman has to be taught to fire—and an annoying process it is sometimes—but if you teach him to fire with an arch, he will make a much better fireman than if he is taught to fire without an arch, because a man that can fire properly with an arch can fire anything; whereas a man may be able to give good satisfaction on an engine without an arch, and be entirely out of business if put on an engine with an arch.

In conclusion, if brick arches are put in, in a common-sense way, with just enough space between the arch and flues to permit of the free circulation of the gases, and at the same time not allow the opening to become blocked with cinders, and high enough that a good fire can be kept under them with reasonable ease, we believe they will be found to show a decided improvement in steaming qualities, fuel consumption and the life of the flues; and if your engine begins to leak after one has been put in, do not blame the arch, for there is nothing about it, everything else being right, that will cause flues to leak. GEO. B. NICHOLSON.

Chapleau, Ont.

ELECTRICALLY DRIVEN INSPECTION CAR.

Electrically Driven Inspection Car.

Please find enclosed photograph of hand car equipped with a 2½ horse-power simplex engine. This car is used by our chief engineer, Mr. R. N. Hudson, as an inspection car, and is giving entire satisfaction in every respect. It has been in use almost ten months. The engine is equipped with dry battery, also a small dynamo. The car is started with battery, and when it attains a speed of about six miles per hour the dynamo is put into service and does the exploding of the gasoline.

As cars of this kind are attracting the attention of railroad men throughout the country, I thought probably this would be of interest to your many readers.

Cloverport, Ky. P. D. PLANK.
Master Mechanic.

[It seems to us that this arrangement of electricity for exploding the gasoline might be used with advantage for automobiles.—Ed.]

Does the Brick Arch Cause Leaky Flues?

In answer to M. D. Corbus in January number, "Does the Brick Arch Cause Leaky Flues?" would say, I do not think so. Here on the Louisville & Nashville we use the brick arch in all engines in road service, and find it not only prevents flues from leaking, but prolongs the life of same by protecting them from the cold air that rushes in every time the fire door is opened. Our arches are supported by lugs screwed into side sheets of firebox; a space of from 4 to 6 inches between bottom brick and flue sheet, and the bottom of arch a few inches below, bottom row of flues depending on depth of firebox, and about 20 inches above the grates. We find with the use of the arch it is more difficult for the exhaust to pull fine coal and cinders through the tubes unburned, stopping up same, and to tear holes in the fire. The arch becomes intensely hot and tends to maintain a more even temperature in the firebox, and prevents black smoke to a great extent by consuming the gases.

I have been running here in continual service for three years, and during that time have had one engine failure from leaky flues, and this engine had been in service some years. And I ran an engine every day on local for four months without renewing arch or having flues cleaned, and ran this engine for twelve months and never had a leaky flue. So I cannot believe the arch detrimental to firebox or flues, and believe it effects a marked saving in coal consumption.

H. J. McGrade.

Mobile, Ala.

Long and Short Valve Travel.

I think the point raised by Frank Gleason about the valves of the American locomotives sent to England having too long a valve travel for economical use of fuel is well taken. I have had considerable experience with locomotives with valve travel ranging from 4 to 6 inches, and I have never known a single case where the engine with the short travel valve did not burn considerably less fuel than the other. It is rather difficult to reason what the cause of this may be, but nearly all engineers of observing habits will agree that this statement is correct.

My own impression is that the cause of the difference is in the way the exhaust operates in locomotives with long and short valve travel. With the long travel the exhaust port opens very fast, and steam goes out with a series of beats that sound like semi-explosions. This has a destructive effect upon the fire. With a short travel the exhaust port opening is comparatively slow, and the action of the steam passing out has more the character of a sustained blow than the other. The sustained current of exhaust steam will have a softer effect on the fire than the snappy beats, and will generate steam as freely without pulling through so many sparks or tearing up the surface of the fire.

It has become the custom nowadays for designers of locomotives to ignore the lessons of experience gained by running locomotives, and railroad companies have to foot the bills for increased expense in operating. Things that have never worked satisfactorily are forced into use by the designers' dictum, and the act is called advanced engineering, although irrepressible inefficiency sometimes makes them return to old practices.

This subject of long and short valve travel is so important that your readers who have noted the difference ought to send you their views for the benefit of the long-suffering engineman.

Albany, N. Y. A. McL. Conveth.

Brick Arch Causing Leaky Flues.

With the exception of the past year, my experience on locomotives has been entirely on engines with brick arches supported by arch pipes. I have always found a brick arch valuable when placed high enough above the grates to allow coal to be scattered in the front end of the firebox. If the arch is too low, or a poor quality of coal is used, and fire gets heavy, then look out for the leaky flues.

As the fire now next to the flue sheet is too close to arch to receive more fuel, it soon dies out, allowing cold air to strike flues, causing them to leak badly.

When regular crews were assigned to engines we were not troubled much, as we made a point to keep the fire thin enough to allow plenty of room under arch. But after the pooling system started things were different. When a crew started out the idea was to get to the other end of the road with as little delay as possible. Sometimes when twenty-five or thirty miles from the end of the division the fire would get heavy, and as a few minutes lost on account of engine not steaming in this condition would not amount to the time lost cleaning fire, we would keep going, resulting in flues leaking badly on arrival at terminal.

A. F. Hendricks.

Springfield, Mo.

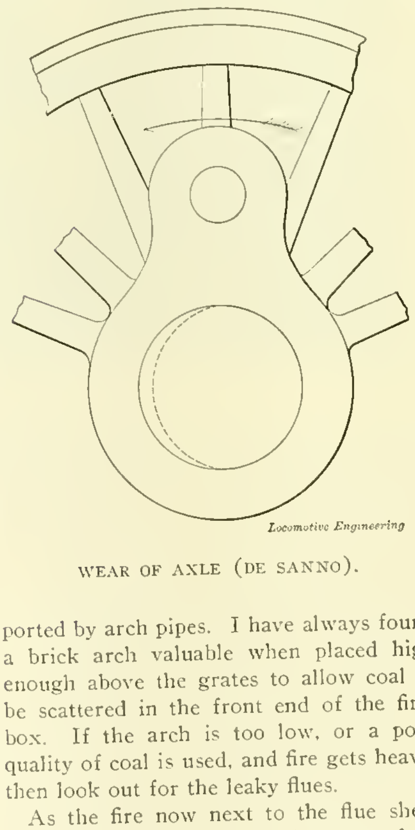
A Good Fuel Record.

The following, taken from the *Pittsburgh Gazette*, in the *American Railroad Journal*, November 15, 1851, page 727, is interesting:

"To Ellwood Morris, Esq., Engineer, Chartier Company—Sir: Agreeably to your instruction, I weighed upon my tender *two tons*, or 60 bushels, of coal, from the Chartiers mines (Pittsburgh coal), and using a few chips of wood for lighting fire, I ran the Baldwin engine 'John Thompson,' of 15 tons weight (six drivers connected), a lineal distance of 60 miles, drawing the usual loads over our grade of 145 feet per mile, and curves 550 feet radius, firing up five separate times. This coal was burned in firing up, running and standing under steam, while performing the above distance of 60 miles, making *one bushel per mile run*, Pittsburgh coal being used *exclusively*, and no wood carried on tender.

"Edward Mahony,
"Engineer of Locomotive."

Wear of Driving Axle and Hubs.



WEAR OF AXLE (DE SANNO).

Enclosed sketch represents the peculiar wear of the main axle of a large compound. It was on left, or H. P., side of engine. The dotted line shows wear of journal and its relation to crank pin. The journals are 9 inches in diameter, but required reducing to 8½ inches to make it round. No, it did not show to be badly cut; in fact, the worn side was comparatively smooth. What caused it?

To avoid cutting between steel boxes and steel hubs why would not vulcanized fibre, such as is made from leather scrap, give good results? The hub liner could be held in place by copper studs.

Kern, Cal. W. de Sanno.

Static and Kinetic Energy in Action of Injector.

I read with interest Mr. Conger's talk on the injector and its workings in your February number, just at hand.

Almost all explanations of the principle of the injector that I have ever heard explain, as does the article referred to, that the velocity of steam is so much greater than that of water from the same boiler (and consequently at practically the same pressure) that the check is raised and the combined jet of water and steam nters the boiler. It strikes me that all such explanations would tend to the inference that if the check were above the *water line* in the boiler there would be nothing fed to the boiler. I believe many of your readers know that this is not the case, and hence I prefer to dwell upon the difference between the *static* or stationary energy and the *kinetic* or moving energy.

We all know that one man running against another of equal weight who is standing still does not bound back, but pushes the man he strikes ahead and himself goes on beyond the place where the collision occurred. In switching cars of equal weight in yards the same result may be readily noted. The moving car strikes the standing one, shoves it on, and itself moves beyond the point they collided. This, to my mind, clearly illustrates the results of *kinetic* or moving energy over *static* or stationary energy. However, if both cars were moving at the same rate toward each other on level track, both cars would stop dead where they collided if there were no springs between the buffers or drawbars.

There is a natural law that no force is ever wasted, but appears again in some other form. To get the one car moving required considerable energy, which shows itself in the result when the two cars collide. So I explain the injector working, whether it delivers into the boiler above or below the water line—the steam at first used which starts the flow in the branch pipe is like the first energy required to start the one car moving, while the check valve holds the pressure on top of it from rushing back toward the injector. When the two come together, or collide, the moving mass (in the branch pipe) shoves the stationary mass in the boiler—whether water or steam—ahead of it, and itself slips beyond the check valve, or the point where they collided.

There is another theory that I cannot understand at all, which is that a boiler will steam much better if the steam valve be opened not too wide. Now, I can see that if I were taking the contract to deliver so many gallons of water into a *tank* at a certain pressure that I should use as little steam as possible to get the water to the tank, and not lose money by heating up all this water for no good reason. But if I were to agree to not only deliver the water against the given pressure, but to subsequently make it into steam at 200 pounds pressure, there would be no loss in my using too much steam in the injector (provided it takes up), and delivering the water so much hotter that it would require less subsequent heat. Someone will say: "The friction is greater." True; but the branch pipe don't *cut away* inside as a result; so the friction simply produces more heat, which must all go into the boiler, as the branch pipe is short and the radiation not considerable for a large boiler.

You will, I hope, see that while I agree that in testing an *injector* it should be shown how much water can be delivered with the least amount of steam, yet in testing an *injector and boiler* combined, I can't catch on. Will you or some one of your many intelligent readers help me out? E. W. Pratt. C. & N. W. Ry.

Hard Steaming Engines.

My friend Doc, who told us in the December number that he was going to quit kicking, has got so worked up on account of a poor steaming engine that he has broken out worse than ever, and tells a doleful tale after the following style. He says that he did not know what was coming when he told me last fall that he was going to quit kicking and be satisfied with the way business was done:

They got a lot of new engines just as winter set in good and cold. Some of them are simples and some are compounds. He has run all of the passenger engines in the pool, and it is a holy terror the way they don't steam. He has been *pulling at* a heavy fast train all winter, but it's no use talking, some of the new big engines do not steam in proportion to the size of their boilers. A few of them are big enough to handle twenty coaches, if they would steam freely, but they have hard work making time with ten. And this trouble is not confined to our road. "I hear from the men on the other roads. It is all the same cry: 'Engine don't steam.' There is no use saying that it takes more steam to draw the train, for the train has the same cars we had last winter, and the electric headlights, steam heat and air pump can't use any more steam than they did then.

"We have tried all kinds of ways of working them and all kinds of ways of firing, but it is no go; they keep dropping back on steam till we are glad to see an order board out so we can shut off and blow up. I tell you what it is, they are trying too many experiments with the front ends and setting valves. Why, when we had 17 x 24-inch engines, with diamond stacks and boilers not near as large in proportion to the cylinders as we have now, we used to have engines that would steam anywhere if we passed enough coal into the firebox. When we changed to straight shot stacks and long front ends, they began to burn more coal and make less steam. We thought it was because we had not caught on to the proper way to draft them, but we have not caught on yet, by a good deal. Because a few sparks came out of the stack they began to put in fine netting that choked down the draft so the nozzle had to be made smaller to get any pull on the fire. Next, they found out that a small stack would allow a larger nozzle, and they tried that. We got a better pull on the fire, but when the engine was working hard they burned coal to beat the band. Then they began to monkey with the front end and try all kind of experiments with short nozzles and long nozzles, with large netting area and with diaphragms and aprons like a letter Z to make the cinders tired of life. Progress is all right, but I think there is too much experimenting and not enough of let well enough alone. There are some natural laws that don't change; one of them is 'no fire, no steam.' Engines are like humans in one way. You know what is one man's meat is another man's poison, and what makes one engine steam good won't help out some of the others; but the shop force won't believe that. If one engine steams good with a certain arrangement of draft appliances, they fix some more that way. Maybe they steam and maybe they don't.

"I have got a big kick on the way they set the valves, too. Many an engine goes in the shop with a dirty boiler and leaky flues, but she is a fair steamer and will pull anything that is loose at both ends. She gets a good overhauling—new flues, boiler cleaned out, front end put back just as it was before, and any changes in her boiler are in the line of good steaming; but she don't steam as good as before nor do her work as well. The only thing changed that could do that is the setting of the valves. If you talk to the valve setter he gives you the laugh, and that is all the satisfaction you have. The master mechanic is in just as big a sweat as anybody for he wants the engines to steam.

"Most always they blame it on the coal we get from the land department—the fuel department surely don't handle such stuff.

"That reminds me that I was down East last fall, and was riding on some of the wide firebox engines. My! how they do steam. The harder they are worked the better they steam, and right against both injectors, too. They were burning slack coal, about half soft and half hard. Our engines would die on that stuff before they got out of the yard. I believe that it is the shape of the firebox, as well as its size, that makes them such good steamers. The steam goes right away from the sheet up through the water as soon as it is made, instead of hugging the sheet all the way up to the crown. They say you can't burn soft coal in a shallow, wide firebox, but they seem to be doing it in shallow narrow ones where they set on top of the frames over the back driving axles.

"We will have to change the shape of the fireboxes if we make them any larger. They are about 7 feet deep for the deep ones and about 10 feet long for the shallow ones, and not enough firebox heating surface yet to make the steam needed. What we want is more heating surface in the firebox and less in the flues, but we won't get it very soon. I used to think a short nozzle and a petticoat pipe was just the thing. Our engines have them, and when the petticoat pipe gets out of plumb just a little bit they quit steaming. They don't use a plumb line and straight-edge half often enough in our modern engines; some of them have the exhaust hit the side of the stack instead of going straight up the middle."

Doc's trouble is not an uncommon one by any means, and the bright men in the locomotive department are not able to make all the engines steam free.

Why is this?

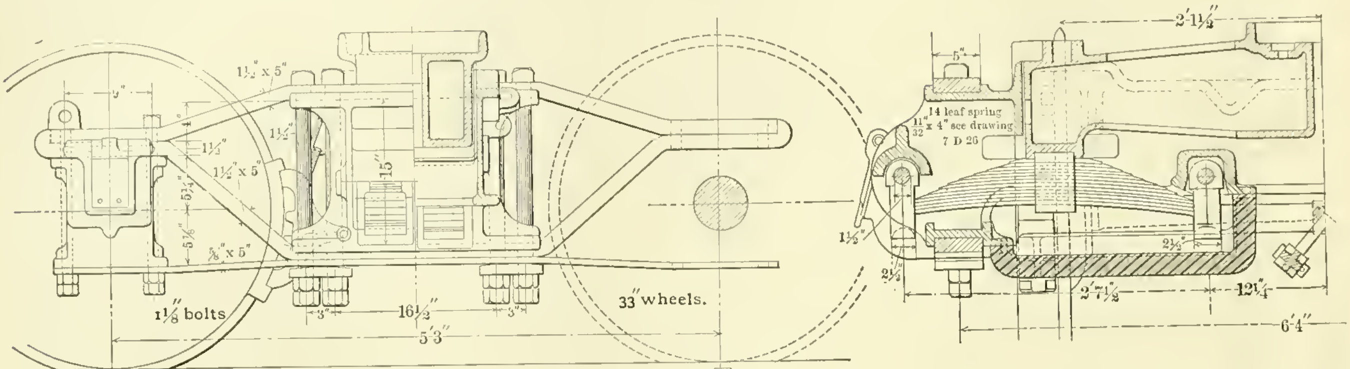
Leeds Tender Truck for 5,000-Gallon Tank.

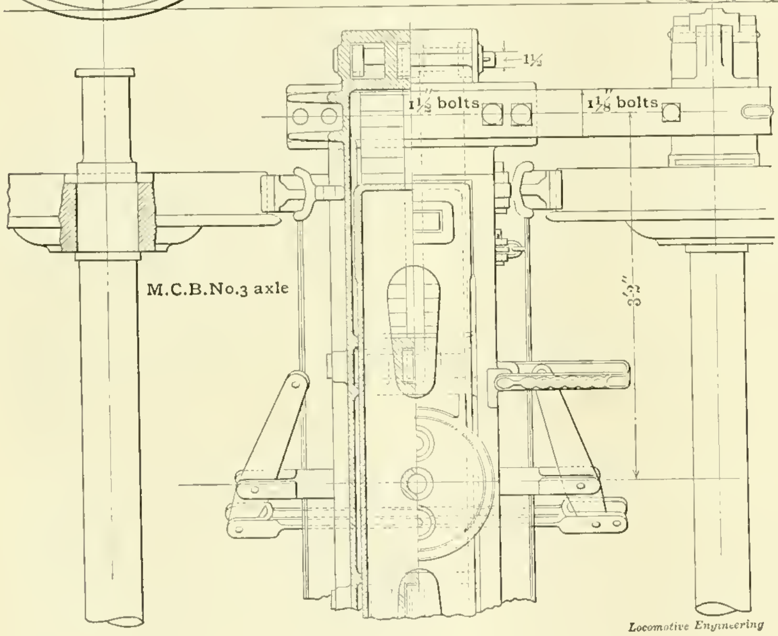
This is a modified form of the standard Louisville & Nashville tender truck, which was made up with channels and end castings. These used a sandwiched bolster on half-elliptical springs, but without hangers, so that the springs slid on their bearings at the end.

The special features are the outlines, distribution of metal and the method of hanging springs. Mr. Leeds has found that a half-elliptical spring gives them better results than the full elliptical, so they have used it in this truck. He admits that the design would be more simple and the truck cheaper to have used the full elliptical, but their experience shows that the cost of maintenance of the full spring far exceeds that of the kind adopted. The tenders also ride better under all conditions of load with the half springs. The dish-pan under the spring is to catch any pieces that may break.

One of the novelties of the design is the detachable center-plate and side bearings, although, as they have used it on all steel bolsters in their freight car trucks, it is not a novelty on that road.

Mr. Leeds thought that if provision was made for replacement of the wearing parts, such a bolster should last forever, and so designed them with the detachable center-plate and side bearings, as shown on this one, and the column guides are also separate on the freight truck, having bosses so as not to depend upon any bolts to keep them in place. This gives the best known wearing metal for bearings, *i. e.*, cast iron, and at the same time provides for adjustment of the height of the car by using center-plates and side bearings of the desired thickness, a provision that we have not seen on any of the iron or steel bolsters. Some may claim that they do not need any adjustment, but observation does not substantiate the claim.





LEEDS STEEL TRUCK AND BOLSTER.

A Legible Time Table.

Far too many of the working time tables furnished engine men are not got up with the idea of giving good service. A time table is usually of such shape that it must be folded at least once, more often two or three times, in order to get it in the pocket, and thus comply with the rule to have one in your possession at all times when on duty. The folding tends to change the shape of the figures that come in the crease of the paper. It very soon wears through, and the place where a hole has taken out the figures may be the most important part of the schedule for that train. Some cards are of such poor paper that they will not last a week if carried in the pocket; if placed in a rack or pocket in the cab it is no better, and the colors vary from white through all the shades of blue, red and others, with the idea uppermost that a change of color will call attention to a change of card. This is a good idea in theory, but the time table should be printed on the color of paper on which the printed figures can be most readily and certainly distinguished at night. The light in the cab of an engine is never of any use for close work, and a torch does not help out very much. As to the change of colors, there is surely some other plan for making sure that the card in use is the current one.

An ideal time table for service on a locomotive should be of a convenient shape to get open at the proper place; of such a color of paper that it can be easily read; of such a quality of paper that it will not wear out very soon, and, if possible, that it will not soil easily. The engine man cannot keep his hands as spotless and white as the office man; in his wrestle with the unwieldy time cards to find the schedule of his train his fingers are liable to leave their mark, whether he wears gloves or not. If this finger mark comes on the schedule that card is of no use to find the stopping points, whether flag or regular. Some of the signs are just visible when clean. We are sure if this matter of providing a legible and durable card for employés' use was taken up by the officials who get them out a vast improvement would result.

The clear, distinct printing and convenient size of the time tables of some roads is in decided contrast with the poor work on others, to the credit of the good ones. If one line can have distinct and durable cards why cannot all of them?

When at Oneonta recently we noticed that the Delaware & Hudson practice is to adhere to the oval hand plates for boiler washouts on the corners of the water leg. This is a little more expensive than the screwed plug, but gives a better chance to wash out, as the hose nozzle can be handled much more freely than with the small round hole. They say there is no difficulty in keeping them tight if ordinary care is used in making the joint.

Two Heavy Electric Motors.

The photograph at the left shows a 25-ton locomotive constructed for the Imperial Lumber Company, of Toronto, for use in shifting standard railway equipment around their yards in transferring to steam railway tracks. The general dimensions are:

Four 50 horse-power motors.

Drawbar pull, running—4,000 pounds.

Drawbar pull, starting—6,000 pounds.

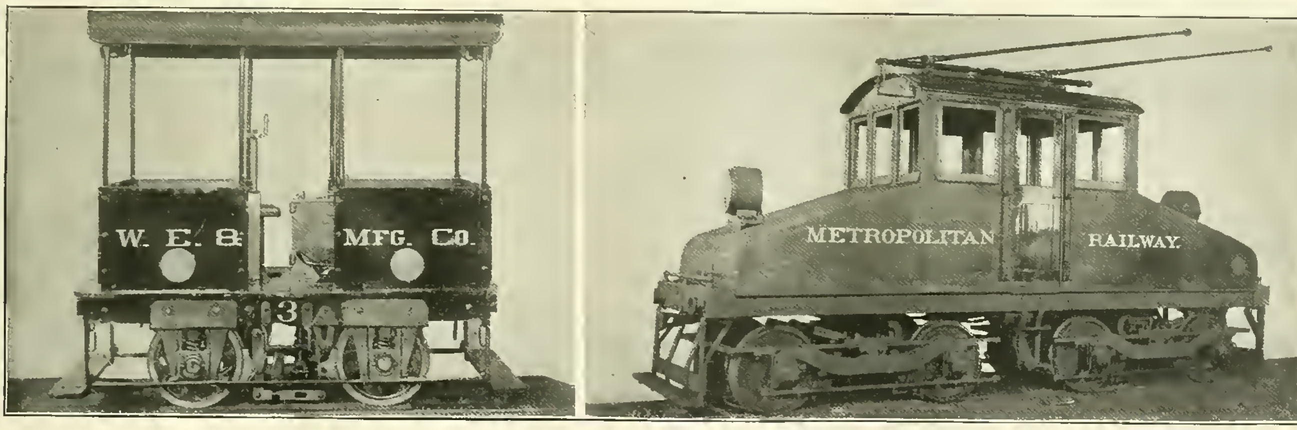
Diameter of drivers—33 inches.

Total wheel base—18 feet.

Journals—3¾ x 7 inches.

Full load speed—15 miles per hour.

This type of locomotive is well adapted for switching work and can be made of any desired weight and hauling capacity, from a minimum of 20 tons to a maximum of 50 tons weight. It consists of a strong, well-braced channel iron frame, similar to a tender frame, on which is built a central cab having two end wings. The cab proper contains the brake apparatus and controller, electric air pump and all necessary devices for the operation of the locomotive. The end wings are used for housing the diverter or rheostat required for the variable operation of the locomotive.



TWO HEAVY ELECTRIC MOTORS. BUILT BY BALDWIN LOCOMOTIVE WORKS.

The trucks are of a special locomotive type, having wrought iron frames, transom and pedestals constructed in a very similar manner to those of locomotive leading trucks. The boxes are provided with regular locomotive driving brasses. On each axle is mounted a single reduction geared motor of the special slow-speed railway type made by the Westinghouse Electric and Manufacturing Company.

The accessory apparatus includes complete air-brake equipment, Shea air sander applied to all wheels, whistle, bell and electric headlights.

The other engraving shows a small yard switching locomotive for light haulage around the shops of the Westinghouse Electric and Manufacturing Company, at Pittsburgh. The general dimensions of this locomotive are as follows:

Length over end sills—9 feet.

Wheel base—4 feet.

Width—4 feet.

Track gage—2 feet 2 inches.

Height of floor above rail—30 inches.

Height from rail to top of cab—8 feet 6 inches.

Diameter of wheels—24 inches.

Weight of locomotive complete, with storage battery—8,500 pounds.

Weight of storage battery only—2,500 pounds.

The battery consists of sixty cells, type 7-E, made by the Electric Storage Battery Company, and has a capacity of 2½ horse-power continuously for eight hours, 5 horse-power for three hours, and 10 horse-power for one hour. At starting, or for momentary work, the battery has 20 horse-power capacity, or sufficient to utilize the full adhesion on the wheels.

It is believed that a battery of this capacity will do intermittent work for eight hours per day without recharging, and can be recharged in three hours' time if necessary. The motor equipment of this locomotive consists of two single reduction motors, one geared to each axle, the motors being of 10 horse-power each. The locomotive has a controlling apparatus of the usual kind, and hand brake actuating on all wheels. It will be noted that the locomotive is adapted for an extremely narrow gage of track, and has a considerable hauling capacity at slow speeds.

The storage battery is mounted in two boxes, one on either side of the central doorway in the cab. The motorman stands or sits at the center, having the controller and brake apparatus conveniently at hand. The operation of this type of locomotive is convenient and is said to be cheap, which gives it a large field for use in factories where an electric power plant is at hand to recharge the battery.

Skill of Motorman Increases Efficiency.

A test made in Philadelphia by Mr. Charles Hewitt, of the Union Traction Company, of the amount of electric energy used in operating a street car motor showed that it depends greatly on the motor man. One man who is skillful in handling his motor and as economical as possible in the use of the power will take into consideration the varying conditions and resistance of the cars and make a much better record than some of his fellow motormen.

It was found that there was a difference of 43 per cent. between the man who used the most power and the one who used the least with the same motors and cars. An instrument for measuring the electrical energy they used was attached to the car, and as a number of men ran it in their turn, the difference was easily found out. To apply this to locomotive practice: If each of these men got all the work they could out of the engine it would mean that one man could draw 43 per cent. more tons than the other. This would be a decided difference in the size of the trains. But if computed on the basis of coal and water used, it would mean 43 per cent. more for one engineer than the other. This great difference would call the attention of the officers at once, and the lowest man would also have an interest in making a better showing. That is where a performance sheet comes in handy. We would advise our electrical friends to make up such a sheet, showing how much electric "juice" each motorman runs through the motor. They may not get on to all the points in which a locomotive performance sheet does not tell the exact truth, but if their meters are correct they can get that part right.

A motorman can draw all the power he wants up to a certain limit, and no one appreciates it except the central power plant, but the amount a locomotive engineer can use is limited to the steaming capacity of the boiler or the capacity of the tender. This teaches him habits and methods of economical operating.

We understand that the Brooklyn elevated railroads are preparing to haul freight over their lines at night for distribution at various wholesale depots. This will do much to relieve the congested traffic of heavy trucks on the streets. The plan is worthy of general adoption, and the prospects are that it will be a paying enterprise.

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What Does it Cost to Run Trains at High Speed?

A practical question in locomotive operating which every railroad man ought to know more about is, "What does it cost to run trains at high speed?" We have devoted considerable attention to this subject for years, but we have not been able to find any reliable data relating to it. A great deal has been said and written concerning the extra expense involved in running trains at very high speed, but no records of experiments were ever given to show the relative cost of moderate and high speeds. Theoretically the cost of running at high speeds ought to be greater than the cost involved in moving more slowly, and as far as we can find out the estimate of the cost of high speed has nearly always been worked out from a theoretical basis. That is, however, by no means a safe foundation for elaborate calculations. A great many instances have happened in engineering where *a priori* reasoning led to very erroneous conclusions.

When we recently learned that Mr. F. A. Delano, superintendent of motive power of the Chicago, Burlington & Quincy Railroad, was going to present to the Western Railway Club a paper entitled "What Does It Cost to Run Trains at High Speed?" we naturally concluded that new light would be thrown upon the subject, based on research; but Mr. Delano has done little more than offer the question for discussion. He did some reasoning from an uncertain formula concerning train resistance, from which he figured that it would require 62½ per cent. more fuel to run a train at 60 miles an hour than it would take for moving the same train at half that speed. From indicator diagrams recently taken he found that they demonstrated a drop of 42 per cent. in mean effective cylinder pressure for an increase of 30 miles per hour. This is offered as testimony of the decreased efficiency of the engine that keeps pace with increase of speed.

This does not accord with our experience. We have known analogous cases, where the cut-off was increased 5 or 6 per cent. as the tractive power began to decrease with the acceleration of speed, and then the power was maintained without the consumption of steam being increased. This is contrary to theory, but it agrees with D. K. Clark's famous discovery that "expansive working was often expensive working."

The question of cylinder condensation enters as a very important factor in the expense of running trains at any speed. Every observant man who has run locomotives is aware that there are cases where it is decidedly more economical to cut off steam at 30 per cent. than it is to cut off at 25 per cent. of the stroke. This introduces one of the many variables which make abstract reasoning concerning the cost of running trains at any kind of ,speed an uncertain means of getting information. If a railroad company would experiment a little with trains of a given weight run at different speeds and collect records of the fuel and water used, it would furnish data which the engineering world would appreciate as being valuable and worthy of praise.

The meagre facts that the railroad world possesses regarding the consumption of fuel necessary to maintain different train speeds do not indicate that slow running trains call for the smallest expenditure of coal. Years ago, when Mr. Charles Paine was general superintendent of the Lake Shore & Michigan Southern Railway, there was a popular belief that the most economical speed for the running of freight trains was about 15 miles. Mr. Paine is an engineer who prefers proved facts to opinions, and he determined to carry out experiments to demonstrate what speed was really the most economical from the standpoint of fuel consumption, and it was found to be about 22 miles per hour. The fastest train in the world is the Empire State Express, run daily over the New York Central Railroad. The engines pulling that train are fairly loaded, yet we have been informed by the officials of the New York Central that the engines pulling the Empire State Express burn less fuel per car mile than the engines hauling other trains of similar weight and slower speed.

A matter nearly always lost sight of by those discussing the relative cost of high and low train speed is, the load put upon the locomotive. If an engine is loaded close upon its highest capacity, say 40 miles an hour, and it becomes necessary to increase the speed to 50 miles an hour, it is manifest that the extra work will be done at considerable extra consumption of coal. Should, however, the load be well within the capacity of the engine, the increase of speed may be accomplished without any extra demand upon the coal supply.

The piston speed has a great deal to do with the economical operating of a steam engine. The belief used to be almost general that, within ordinary limits, the slower the piston speed the smaller was the volume of steam required to perform certain service. This is a fallacy which has long been exploded, for it was proved beyond question that slow piston speed always entails high cylinder condensation of steam, which greatly overbalances the advantage gained by the superior expansion of steam and the reduced back pressure due to low speeds.

It is probable that every steam engine, including locomotives, has a certain piston speed at which the steam is used to the best advantage. But with engines having the cylinders so badly exposed to chilling influences as the locomotive, the most economical piston speed is seldom below 500 feet per minute, and it may be nearly double that. The reason why the engines pulling the Empire State Express do the work with unusual economy may be that the piston speed required is more economical than that which must be maintained by the other passenger engines; and the load being well within the capacity of the Empire State Express engines, full advantage is enjoyed of the steam expansion.

In support of the arguments we have advanced we would quote from a report made by Prof. Goss several years ago concerning the performance of the locomotive "Schenectady" in the tests department of Purdue University. We quote:

"The steam consumption per indicated horse-power per hour varies with the speed, and is minimum for a speed of 35 miles per hour (188 revolutions per minute, or 752 feet per minute).

"The steam consumption varies with the cut-off, and is not minimum for the shortest cut-off, except for a speed of 55 miles an hour (296 revolutions per minute, or 1,184 feet piston speed per minute). This fact confirms an opinion which was reached after a study of previous tests upon this engine, viz., that a cut-off of about one-third stroke gives maximum results. If the load to be carried is light, it is more economical to use an 8-inch cut-off with a partially closed throttle than to run with a shorter cut-off and a full throttle."

Advising Boys Against Learning Trades.

We once knew a very bright boy, of well-to-do parents, who had a natural bent towards mechanical pursuits. Like many other boys, he read Locomotive Engineering, and in the course of time he made up his mind that he wanted to be a mechanical engineer. But his mother was of the ultra-genteel persuasion and looked with horror upon the idea of a son of hers having to handle greasy, sooty tools; and so she had him placed in an office where all his work and surroundings were neat and clean. The youth did not take well to clerical work, and being of a persistent nature, he succeeded after a time in getting his mother to consent to let him enter a machine shop as an apprentice. He entered upon that work with enthusiasm, and made wonderful progress during the six or seven months he was permitted to remain in the shop, as we were informed by his foreman. But that length of time exhausted his mother's patience. She hoped that a month's experience in the shop would cure the passion of her son for mechanics, but it had the opposite effect, and she compelled him to leave the shop and return to the office again. When we heard particulars of this we remarked, "Another case of a man's future life being ruined by a snobbish mother."

There are many such cases. Fifteen years ago we accidentally heard a conversation between two ladies who were talking on the piazza of a hotel which was the headquarters of a Master Mechanics' convention. We happened to be sitting close beside them and could not avoid hearing what they were saying. One of them, Mrs. Blank, was the wife of a superintendent of motive power, and she was lamenting the low tastes of her son, Willie, who would persist in loitering about the machine shop and the roundhouse. He even wanted to learn the machinist trade, but she would never consent to that. Sons of people who were below them in social standing were holding positions where they never had to soil their hands, and she was determined that her son should do as well. She had asked her husband to compel Willie to go to college and prepare for some respectable career, such as a lawyer or doctor.

This woman had been married when her husband was a machinist, and he never would have been anything more than an indifferent foreman, had not a series of fortunate circumstances pushed him up to the top of the tree, so to speak.

A series of consolidations, within five years of the time we heard the conversation referred to, left the husband out of a position. There were no savings to keep the family going while the father waited and searched for a position similar to that which he had lost, and within a few months he entered the supply business for a brief career, selling goods. After that experiment he was glad to accept a position as general foreman, with less pay than he would have earned as an engineer.

About a year after Mr. Blank went back to the position of foreman, the writer happened to call at the shops where he was employed. In the course of conversation we learned that Willie graduated from the high school and had been about a year in college when the changes came. "Of course," said Mr. Blank, "I could not keep him there after I had lost my position. He is now working as a clerk in the freight department."

Willie may do well in the freight department and have no cause to rue missing his ambition to learn the machinist trade; but if he is ambitious and has mechanical tendencies, he will probably come to think that the privilege of keeping his hands soft and clean, and of wearing a white shirt every day of the week, is a luxury that may be bought at too high a price. A man with a good trade, who is willing to learn the scientific part underlying the business, is in a better position to enter the battle of life with prospects of gaining a high position than the man belonging to any other calling. If he cares for nothing beyond learning the manipulative part of the trade, his chances of advancement are much less to-day than they were to his class twenty-five years ago; but a good machinist is a much more independent man than a good clerk. We pity the mothers who throw obstacles in the way of their sons' acquiring the indestructible capital of a good trade.

Waste of Money on Erie Canal.

Ever since the Erie Canal was constructed it has formed a sink hole into which millions of dollars have been steadily poured, without benefit to anybody except the succession of rings and lobbyists who have fattened upon the appropriations made for the maintenance and improvement of the canals. Last year there was something approaching a public scandal concerning the way that an appropriation of $9,000,000 for the improvement of the canal had been spent, and it was believed by many people that there would be no more money raised to aid the canal, and that it would be permitted to follow its natural course of decay. Two commissions have recently reported to Governor Roosevelt on matters bearing upon the Erie Canal, and the result is that he has recommended the expenditure of $60,000,000 for the further improvement of the canal. The recommendation is an outrage upon the vast army of taxpayers who can receive no benefit from such a stupendous undertaking.

The New York Commerce Commission, which made one of the reports that excited the Governor to his great fit of extravagance, made a fierce arraignment of railroad companies, and asserted that they were diverting trade from the port of New York through discrimination in rates. That is merely bearing false witness; but it is the old tactics which the merchants of New York and the supporters of the Erie Canal have always practiced ever since the canal was made. The merchants of New York have always been noted for the schemes they adopted to bring trade to the port, but they have been equally celebrated for their success in making other people pay for enterprises that were to benefit New York city alone. The present wail of these commissioners and others about railroad discrimination is really due to the fact that they cannot induce the railroad companies to discriminate in favor of New York. It is not even justice that these people are anxious to secure; it is the enjoyment of favors not accorded to other ports. While the public men connected with competing ports are doing all in their power to lessen the burdens carried by vessels that trade with them and to make the cost of transshipment as light as possible, the commercial men of New York tighten their pocketbooks and shout, "Come and honor yourselves by doing business in great New York, and enjoy the high prices charged."

The Commerce Commission recommends the doing of a great many things that are likely to benefit the trade of New York city; but in no instance do they say that the city should pay any of the cost. They are particularly hard on the New York Central Railroad Company, and imply that it is the duty of that company to act as a nurse and protector of New York city's interests.

The Erie Canal has been suffering from imbecile management ever since it was a waterway. It always needed help to endure the competition of railroads, and it has never depended upon fair competition to hold its own. Had the canal been left to sink or swim according to its own deserts, like other transportation organizations, it would have been dry years ago and its bed used for some useful purpose.

The money to dig the canal was originally raised by an imposition upon the southern tiers of counties that were injured by its construction. The canal ring of the day engaged to support the building of a great highway through the southern counties if the legislators from these parts would support the appropriations to build the canal. The agreement was made and the canal people repudiated their bargain when the time for paying came. From that day their successors have missed no opportunity to oppose anything proposed for improving land transportation, be it railroads or well-built highways.

When the promoters of pioneer railroads were struggling to secure the support of capital the Erie Canal people made the most scandalous misrepresentations of the cost of moving freight by railroads. It was by the force of misrepresentations of that character that appropriations were secured for the enlargement of the canal in 1837, and nearly all appropriations voted to the canal since that time have been made through false statements about the benefits to be conferred upon the State.

The canal ring were always working out schemes to prevent railroad companies from enjoying unrestricted competition against them. As late as 1858 there was a violent agitation worked up in New York State to prevent the New York Central Railroad from competing with the Erie Canal. The Legislature was repeatedly petitioned to pass a law that would confine railroad companies to the business for which they were originally created, whatever that may have been. The friends of the canal talk glibly about the evils of discrimination, but no transportation medium ever was more unscrupulous in discriminating against certain interests than the Erie Canal was in the days of its power. At one time the toll levied upon salt that came from the West was $21.78 per ton, while the rate on salt from New York State was $1.67 per ton. There were a great many other discriminations, but that was the most striking example. It was the managers of the Erie Canal who first worked up the practice of making freight pay all that the business could stand. We know of no sharp practices followed in transportation business that these people did not originate.

The tens of thousands of people in New York State whose interests suffer from the operation of the Erie Canal and the hundreds of thousands who have groaned for years under the burden of taxation imposed for the benefit of the canal have been very patient and long suffering; but it is to be hoped that the latest imposition, proposed by the New York Commerce Commission and by the Governor of the State, will be sufficient to arouse the taxpayers to the enormity of the sacrifice required of them.

When Governor Roosevelt sent his message to the New York State Legislature recommending the spending of sixty millions of dollars on the canal, Mr. S. R. Callaway, president of the New York Central Railroad, promptly intimated that his company would haul from Buffalo all the grain that could be offered for the interest on the vast sum of money named. This offer will not be considered, because it is not the cheapest transportation of freight that the canal gang are after; it is the securing of big appropriations that can be used in rewarding work that is not expended upon canal improvements.

Valve Setting and Negative Lead.

The practice is becoming common of setting valves so that the admission edge of the valve laps a little over the port when the crank pin is on the center, or when the piston is at the beginning of the stroke. Formerly it was the universal practice to set the valve with a little opening when the piston was beginning to move from the end of its stroke. This was properly called lead opening, or for shortness, "lead." There was an impression that this lead opening tended to make a locomotive "smart;" that is, capable of starting quickly and of attaining and maintaining very high speed. Careful investigation has proved that, while lead opening may help a little in starting, it works against the engine after the links are pulled up towards a short point of cut-off, and renders the working into high speed difficult and expensive. The jerky, reactive sensation that one feels on many locomotives when they are running at high speed is due principally to excessive lead.

Excessive lead is most common with engines having short link radius, since that sometimes increases the lead to nearly ½ inch when cutting off at 25 per cent. of the stroke. It is objectionable in several ways. It makes the engine ride hard; it prevents the engine from running freely; it puts unnecessary strains upon the valve mechanism and axle boxes, and it wastes fuel. These present good reasons why valves should be adjusted to reduce within bounds the lead at the most common working position.

The easiest way to remedy the evils due to excessive lead is to set the valves with what people are calling negative lead. When the valve is set lapping over the admission edge in both forward and backward gear, it helps very much in reducing the lead within satisfactory limits at the point of cut-off where most of the work is done.

In this connection we object to the expression negative lead. It is a contradiction in terms, and is about as sensible as saying cold hot water, dark sunlight, and so on. Many shopmen speak of the valve being set blind when it has the reverse of lead, and we think the expression much more sensible than "negative lead."

Working for a Standard Box Car.

To judge from the discussions that have lately taken place in meetings of railroad men, we conclude that the subject of greatest interest at present is the designing of a standard box car. This is by no means a new topic of discussion, for it has been repeatedly reported on by commitees of the Master Car Builders' Association, but it has received renewed energy at present by being taken up by the Railway Association, which is composed mostly of railroad presidents and general managers, who are sufficiently powerful to have their wishes carried into effect. They are the proper officials to decide on a matter of this character, for the most suitable capacity of a car is a question that naturally belongs to the traffic department. The mechanical department may be left safely to decide on the constructive details of a car of a certain capacity, but their experience does not prepare them to decide on what size of a car is best adapted to the carrying of certain freight to the best advantage for the owners.

From what we have read of the expressions made on the subject lately, we are inclined to think that the favorite size of a car is 8 feet high, 8½ feet wide and 34 feet long inside. That would be a convenient size which those holding diverse views on the best dimensions ought to compromise on easily. It would certainly be a great saving of expense and inconvenience to railroad companies if they could only agree upon the size of a standard car, if it did not remain standard longer than ten years. When a railroad company has many freight cars that are smaller than those of neighboring roads they are at a disadvantage with shippers. This fact has induced many railroad companies to make cars longer than 34 feet, which is taking advantage of those with cars of less capacity. If certain dimensions were generally recognized as standard there would be a restraining influence which would prevent the building of larger cars.

The car whose dimensions have been given has 2,312 cubic feet capacity, and will carry 60,000 pounds of heavy freight easily. That is a good load, but it is not the maximum that may be put into a car, for there are many ore and coal cars now carrying 100,000 pounds. We do not think that the dimensions of a typical car that will be the most economical vehicle of transportation can be settled until the maximum safe load that can be carried on two four-wheel trucks is known. When more than four axles are needed to carry a freight car safely the railroad world will make no mistake in concluding that the limit has been reached. Until that time comes it is questionable if railroad companies will be contented with a standard car to carry a load lighter than its possibility. Railroads lingered a long time with ten-ton cars, and great reluctance was manifested against heavier loads. As early as 1875 a vigorous effort was made to establish a standard car to carry ten tons, but it was defeated, because the railroad companies could not agree upon a particular form. Nothing was said about the capacity being too limited. It was fortunate for railroad companies that a standard was not adopted at that time, for it would have paralyzed for a time the movement towards larger cars, which was successful a few years later. History has an awkward way of repeating itself. It may be that establishing a standard size of box car may be followed by a movement to work towards the maximum size that the trucks will carry. There is no better reason for stopping short at 60,000 pounds as a maximum carload than there was for making 20,000 pounds the limit. The small box car was changed for larger sizes because some roads began building cars that carried 30,000 pounds safely. The 100,000-pound ore car will offer an object lesson of the same kind.

Finding the Weight of Trains.

The system of arranging engine loads on the ton basis has been introduced on many roads, but it is not working so satisfactorily as was expected. In many yards the trains are made up very hurriedly, and those in charge will not take the time to figure up the tonnage, or they do it so loosely that engines very seldom have an approximation of the load they are rated to haul. When they are underloaded it is bad for the company, and when they are overloaded, which happens frequently, the result is bad, for it delays trains and gives cause for irritation from the starting point to the terminus.

To save the labor of reckoning up the tonnage the practice has been adopted of assuming that cars of a certain size contain a load which is guessed at. While they call this tonnage rating, it is really going back to the discarded car rating system. The diversity in the capacity of cars, which has been growing worse every month for years, led to the adoption of the tonnage system, and there is no reason why it should be abandoned for methods of reckoning the load which are recklessly misleading. Yardmasters and others excuse their loose methods on the ground that figuring the total tonnage from the waybills and the dead weight of cars is nearly as inaccurate as car rating, since the stenciled weight of cars is seldom accurate. Mr. C. H. Quereau, assistant superintendent of motive power on the Denver & Rio Grande, in a paper presented to the Western Railway Club on "Ton Mile Statistics," when referring to confusion about weight of trains, says:

"The use of self-registering scales has so extended within recent years, and the expense is so moderate, that it would seem that the actual gross weights of the cars could be obtained without prohibitive expense and would pay in a decrease in overtime and doubling because of overloaded engines. It is also probable it would result in an increase in tonnage rating, as the present prevailing practice of getting train weights undoubtedly results in more doubling than would occur if accurate weights were to be had, and cases of doubling have a tendency to reduce tonnage rating."

If the use of track scales would reduce this evil and show satisfactorily the weight of load assigned to each locomotive, the practice cannot be introduced too soon. But we are by no means confident that track scales would better the case. In a paper read by Mr. C. C. Bonte a short time ago at the Pacific Railway Club on "Accounting for Coal Used for Locomotives," the following facts were related:

"With a view to determining the reliability of track scale weights a tender with coal and water was weighed on the same scales in fourteen different positions, resulting in fourteen different weights, with a difference of 2,840 pounds between the heaviest and lightest weight."

We assume that the scales referred to were as accurate as the average track scales; and if that is so we would rather risk the tender mercies of the old carload rating. It appears that no system of finding the weight of the cars is more than an approximation of the truth, but we think that, all things considered, the plan of taking the weight of load from the waybills and the dead weight from the stenciled figures is likely to be as satisfactory as any in sight. Anyhow, before beginning to equip a road with track scales for the purpose of weighing cars to ascertain the proper engine load, it would be well to make exhaustive experiments to find out the idiosyncrasies of the ordinary track scale.

Handbook of Testing Material for the Constructor.

This book is by Prof. Adolf Martens, director of the Royal testing laboratories at Berlin, and is translated from the German by Gus C. Henning, M. E. Cloth, two volumes, $7.50; published by John Wiley & Sons, New York.

Like most German scientific books, this one is notable for the thorough manner in which the whole subject has been treated. The first volume is devoted entirely to illustrations, and seems to embrace all kinds of apparatus ever used in the testing of material and all sorts of specimens. They tell a very graphic story in themselves. The second volume contains the text, which consists of a very thorough treatise on testing material. The book does not exactly read like the "Arabian Nights," but it is clear and intelligible to those who know a little about the subject. It will doubtless be found a valuable addition to the literature of the tests department, and very little other works of reference will be needed when this one is within reach. The author says that the book is designed to be a counsellor to the constructor in all questions relating to the properties of his materials of construction. It certainly fulfills that purpose and is assuredly the most reliable hand book of testing material published.

Lubrication and Lubricants.

The above is the name of a book recently published by Lippincott Company, Philadelphia; price, $5.50. It treats on the theory and practice of lubrication and on the nature, properties and testing of lubricants, and has been written by Leonard Archbutt, chemist of the Midland Railway, and by R. Mountford Deeley, inspector of motors and boilers, Midland Railway, locomotive department. This combination of authors is a good arrangement for a book of this kind, since chemistry is necessary to ascertain the nature of the lubricant and the mechanical engineer has to testify how it behaves under different conditions of service.

There have been a great many books written about lubricants, but this is the most comprehensive one we have ever seen. The authors do not seem to miss any points of value that have been discovered about the nature or behavior of lubricants. The theory and practice of lubrication are both very exhaustively treated, and it appears to us that the book will at once become an authoritative work of reference.

In connection with lubrication friction of all kinds is discussed in all its bearings. Notes are given of the experimental researches of all the leading investigators of friction, among them being the work of Morin, Rennie, Tower, Galton, Vince, Columb, Thurston and others. From the conclusions arrived at by the different investigators we are led to believe that there is yet a good deal to find out about friction. Practical experience among locomotives and cars leads us to think that there are still many things to be found out about friction not dreamed of in the philosophy of most investigators. The various experimenters on phenomena of friction came to different conclusions because the conditions of their investigations were carried on differently, but there are cases where extraordinary paradoxes in friction are encountered when the conditions of service or tests are repeated with exactness. There are good illustrations of this in the article on "Bearing Surfaces" which appears on page 117 of our present issue. The work done by Messrs. Archbutt and Deeley in clearing up the laws of friction is well worthy of commendation, but the field is still open for more labor.

Hard Riding Engines.

It is not unusual to set new tire on driving wheel of an engine without truing up the outside, but leaving the tire just as it came from the rolls that formed it. Such tires are not always a true circle on the outside, as is easily proved by taking a truing-up cut on them. The engine with these tires will usually ride very hard. A hard riding engine is not only tiresome for the crew and wears out their strength, needed to handle and take care of the engine and train, but the engine will not last as long.

When it becomes necessary to reset a tire that has worked loose on the wheel center, usually because the tire is a thin one, and shims are used, care should be taken to keep the tire the same distance from the center of the wheel all around. If shims are used on one side of the wheel only, it does not need a very thick one to make the tire eccentric with the wheel center. The engine then rides very hard. A truck wheel bored so the axle does not come exactly in the center of the wheel has this same trouble, but a good boring mill rarely turns out work with this defect.

A B C of Electricity at the New York Railroad Club.

Perhaps one of the most interesting entertainments yet provided the members of the New York Railroad Club was that presented by President Vreeland on February 15th—the A B C of electricity, with considerable advanced work on that subject.

President Vreeland introduced Mr. R. B. Williams, who, in the absence of Prof. Durand, of the Scranton International Correspondence Schools, and who had been suddenly called away, would give the talk on the A B C of Electricity. Mr. Williams began his remarks by explaining the actions of the galvanic cell, and touched on static electricity by relating the incident of Franklin drawing a charge of electricity from the clouds by a kite string.

A number of chalk figures on the blackboard served to illustrate the points explained by Mr. Williams as he progressed. The first was a soft iron bar inclosed in a coil of wire, around which a current was supposed to be flowing. This, he explained, made an electro-magnet of the bar, and made it much stronger than the ordinary permanent magnet.

Farraday, who was one of the keenest observers and experimenters of his day, although a very poor mathematician, knew that an electro-magnet could be made by passing an electrified wire around a bar of soft iron. Conversely, he believed that a magnet placed inside of a wire should produce a current therein. He tried it and discovered that no current flowed after the magnet had been placed in the coil; but that at the instant of entering the magnet in the coil and withdrawing it that a slight current was produced in the wire. By making a series of quick entrances and withdrawals of the magnet in the coil, current was caused to flow in opposite directions, according to the entrance or withdrawal of the magnet. This was really the birth of the dynamo machine, as Farraday discovered and satisfactorily explained that a field of force was set up by such action, and that the lines of force cut by the magnet caused the current to flow. This was as early as 1832, yet the dynamo machine was not a practical commercial machine until about 1876.

A later machine of Farraday's was shown in a sketch by Mr. Williams, which consisted of a copper disk revolving between the poles of a horseshoe magnet, the copper disk cutting the lines of force projecting between the two poles of the horseshoe magnet. Another diagram showed the rotating armature of the dynamo machine cutting the lines of force projecting between the north and south field poles of the machines, and illustrated nicely the alternating action of the current. Mr. Williams also explained in this connection the single phase and the polyphase alternating currents. A comprehensive sketch of the direct-current machine illustrated Mr. Williams' remarks on the direct current.

Mr. Williams was followed by Mr. W. W. Potter, chief electrician of the General Electric Company, who explained that the long distance transmission of electric energy had been given and required more study than the generation of the current. He drew an analogy between the transmission of compressed air at a high tension and the transmission of high potential current, and showed that the high voltage transmission was much more economical than the low. A very interesting feature of Mr. Potter's talk was that pertaining to the revolving fields and stationary armature of the huge modern generators being built for heavy electric work.

The principle of transformers was next taken up and illustrated by examples of high generation of currents, such as are had at the Niagara Falls Power Company, where the generators send forth a voltage of about 2,200 and which is then stepped up to 10,000 volts, and sometimes higher. He related an interesting incident of a lighting plant in the West which carries 30,000 volts, and about the wires of which on dark nights a blue haze could plainly be seen.

Single phase and multiphase currents were then taken up, and Mr. Potter explained why the single phase was better for lighting, inasmuch as it resembled in principle the single crank engine, which was likely to stick on the center. In lighting, where the armature never ceased to revolve, its sticking on the center was not had, but was quite likely to occur in motor work. Several sketches on the board illustrated the multiphase and the wiring required to use it. Mr. Potter also explained that the high frequency of the alternating current was now passing into disuse, inasmuch as it had been found objectionable, and that the frequency of 40 and even as low as 25 cycles per second was found to be advantageous, the kinetoscope using but 25 cycles per second, which is sufficient to give the effect of a continuous current in lighting.

Mr. Potter nicely illustrated how the alternating current was sent out from the power station at high pressure to the substations, where it was transformed into direct current and fed out to the trolley lines. A very interesting feature of Mr. Potter's discussion was his explanation of the magnetic blow-out which dissipates the arc made when contact is broken, and which arc, unless destroyed, will cause the metal to fuse when a high pressure or heavy current is flowing, the arc given out by 3,000 or 4,000 amperes being 3 feet long in many cases.

Another very interesting and instructive feature was the deterioration of the insulators on the negative conductors of the underground trolley lines in Washington, which had just been discovered, and doubtless would transpire later in the trolley lines of New York city—the resistance of the insulators being lowered nearly 75 per cent.

Mr. Scarrett, chief electrician of the Metropolitan Street Railway Company, then followed with an exhaustive history of the development of electric traction in New York city. He was followed by Mr. Russell, assistant chief electrician of the Kings County Railroad, of Brooklyn, who explained in a similar way the development of electric traction in that city.

Mr. Frank Sprague was then introduced as the pioneer of electric traction, and made some further remarks which were to the point. President Vreeland explained that other speakers had been invited, but owing to the lateness of the hour would refrain from speaking until some other "electric night."

The entertainment was splendid throughout, and could only be criticised on the ground that it was rather too exhaustive and lengthy. Perhaps it would have been better had the A B C of Electricity been followed out for one night, and the development of electric traction deferred until the following meeting night. However, the entertainment was an admirable one, being very instructive and interesting, and from which no one present failed to derive considerable knowledge on electric matters.

What to do in Case of a Main Driving Axle Breaking.

One of our correspondents writes us: "If a consolidation locomotive should break the main driving axle on one side, would it be necessary to take the side rods off on the opposite side to run the engine home under steam? I am satisfied in my own mind in regard to the matter, but I wish you would ask this question in Locomotive Engineering and see what answers to it will be sent in."

As the subject is of living interest, we are willing to take the suggestion of our correspondent, and should like to receive the views of locomotive engineers or others about what is the best thing to do when that accident happens.

Pittsburgh Compound.

On page 7 of the January issue we showed one of the new twelve-wheel engines built by the Pittsburgh Locomotive Works for the Chicago & Eastern Illinois railroad. They have recently completed a compound engine for this road of the same general dimensions, except the cylinders.

These are 21½ and 33 inches in diameter by 30 inches stroke. The steam pressure is the same—200 pounds. The comparative performance of these engines will be interesting.

Bearing Surfaces.

The proper area for bearings of locomotives is always a vital question, and particularly so in these days of 116-ton engines. It is also a question as to what the bearing surface really is, although the projected area has become the accepted amount.

Taking the case of the Rogers consolidation for the Illinois Central, the main driver bearing is 9 x 13 inches, making the projected area of 117 square inches, with 211.5 pounds per square inch. This is clear enough, and there is no doubt as to the projected area or bearing surface.

Let us take a look at the usual truck bearing, however, and see where we come out. These are 6 x 10 inches, but they are not all bearing surface, as is the case with the driving box. The usual form is to put in two babbitt strips about 1¼ inches wide

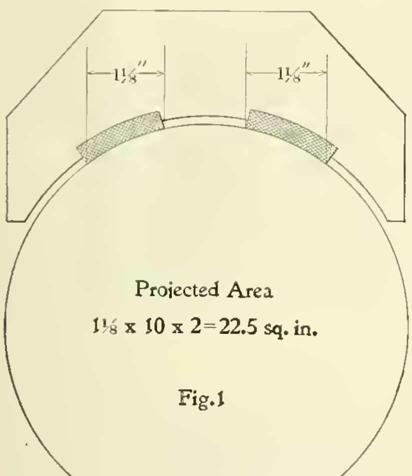


Fig.1

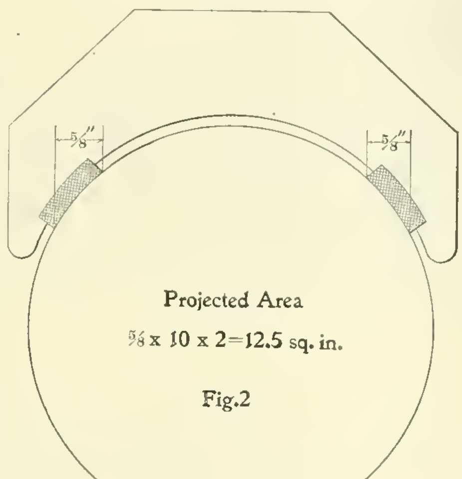


Fig.2

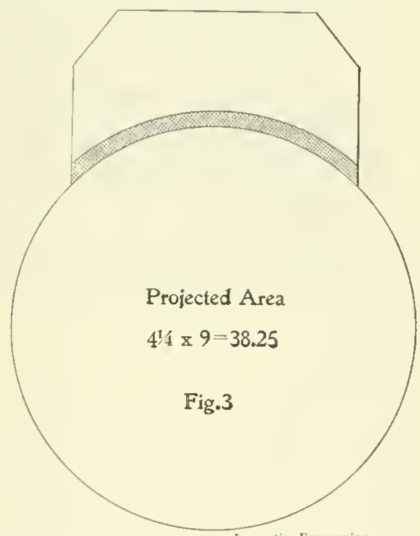


Fig.3

Locomotive Engineering

and the same distance apart, as shown in Fig. 1. This gives a projected area of 1⅛ inches by the length (10 inches) in each strip, or 11¼ square inches. The two strips give 22½ square inches to carry 10,000 pounds, as there are 20,000 pounds on the truck. Dividing 10,000 by 22½ gives 444.4 pounds per square inch of projected area, or double that of the driving-box journal.

Taking the case of some roads who place the strips farther apart, we have an entirely different case. Fig. 2 shows the bearing that is being used by one road, with the strips all of 4 inches apart. As will be seen, the projected area of each strip is but ⅝ inch wide, or 6¼ square inches. The entire bearing is only 12.5 square inches. With the same load as before, 10,000 pounds on a wheel, we have 10,000 divided by 12.5, or 800 pounds to the square inch. Yet they run cool as long as the strips take the load. When the strips wear down, so the crown bears, the box heats up in a hurry in spite of the increased area that is supporting the load. This may be because the lubrication is interfered with, but it is rather hard on the projected area or on the accepted load per square inch.

Car brasses, however, generally bear on the whole surface, and in those which are made on the "square of the axle" theory have a larger projected area. In the case of a 50-ton coal car we have a dead weight of 30,000 pounds, or a total of 130,000 pounds, or 16,250 on a bearing. Allowing a bearing of 9 by 4¼ inches, which is considered ample, there is a projected area of 38.25 square inches. Dividing 16,250 by 38.25, there is about 425 pounds per square inch. The service is very similar to that of a truck, the same tendency to roll out of a bearing when brake is applied (which is one reason for dropping the strips down on the side in the case shown), and it would seem as though the same bearing would give as good service in one case as in the other. There are several sides to this question, and some apparent contradictions in it which might be discussed with good effect.

Anti-Bandit Attachment.

"Every locomotive that is built in the West nowadays has the new anti-bandit attachment.

"On all the new engines of the Denver & Rio Grande Railway are iron pipes extending along the roof of the cab and connecting with the boiler. Through these pipes, without making a perceptible motion, either the engineer or fireman can send, under 200 pounds pressure, a jet of steam and boiling water that would effectually cook anything living that happened to be on the tender or the front end of the baggage car. The diameter of the pipe is 1½ inches, and a single second would drop any man who tried to stand before it in action.

"The steam leaves the pipe at a temperature of about 750 degrees—hot enough to have the toughest of outlaws cooked by the time the train could be brought to a standstill. It will quell the ardor of these gentlemen who make a specialty of holding up engineers from the tender.

"Tramps are fighting shy of this railroad."

The above statement has been clipped from a daily paper, and is given to the readers as absolute truth. We have heard of the invention before, but we feel assured that it has not yet been attached to a locomotive. We are afraid that its presence on an engine would be much more disastrous to train men than to train robbers, even if the temperature of the steam never reaches to half the point mentioned in the description. It shows, however, the fertility of the news collector who is paid by the number of words sent in.

New Engines for St. Paul & Duluth.

The St. Paul & Duluth Railroad have just received three new Baldwin simple engines of the Atlantic type, having 19 x 26-inch cylinders, 72-inch steel wheel centers, with a weight in service of 139,000 pounds. The trailing wheels are 48 inches diameter and have steel axles, 8 inches diameter, the same as the main drivers. Standard steel engine truck wheels, 36 inches diameter, are used.

The boilers have 171 square feet of heating surface in the firebox, 2,073.5 in the flues; 2,244.5 square feet in all. This large heating surface makes them good steamers. They carry 185 pounds of steam. Richardson balanced valves are used and the J. Snowden Bell front end.

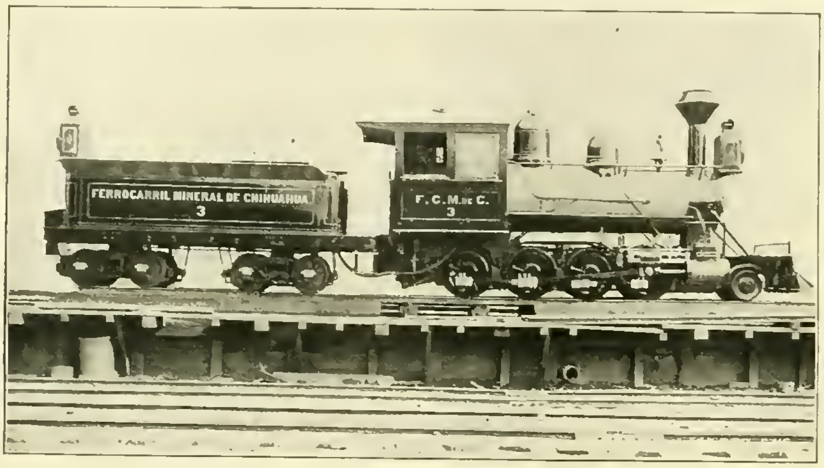
We note that the engine bell is set up next the stack, where the sound will go ahead and warn persons ahead of the coming engine—something that a bell located next the cab does not do.

The tender holds 5,000 gallons of water and a proportionate amount of coal. It is carried on steel wheels, with 5 x 9 journals. The Lindstrom tender connections are used for water supply to the injectors. Westinghouse air-brake equipment is on all wheels, with a 20,000 cubic inch main reservoir. These engines will go into the fast passenger service between St. Paul and Duluth.

Two Porter Locomotives.

We are apt to think of a four-wheel connected switcher as being rather light, while a consolidation calls to mind a large, heavy engine. That this is not always the case is shown by the two illustrations of engines turned out by the H. K. Porter Company, of Pittsburgh, Pa.

The switcher is a 15 x 24-inch standard gage engine, with a wheel base of 7 feet. The boiler is 48 inches in diameter, driving wheels 46 inches, grate area 12.6 square feet, tank 1,200 gallons, boiler pressure 160 pounds, and weighs 80,000 pounds.



LIGHT CONSOLIDATION FOR MEXICAN NARROW-GAGE ROAD.

The consolidation is a 12 x 16-inch engine, 36-inch gage, 33-inch drivers, 20-inch truck wheels, rigid wheel base 10 feet, total wheel base 15 feet 4 inches, grate area 10 square feet, boiler pressure 150 pounds, and weighs but 47,000 pounds.

The Smoke Nuisance Sixty Years Ago.

Ever since steam boilers came into use there have been agitations to prevent the owners from permitting the nuisance of smoke, and the practicability of smoke prevention has been demonstrated often beyond any question, but vigilance flags after a while and bad practices are endured without protest until another agitation arises. The following notes are taken from a life of Sir William Fairbairn:

At the British Association meeting at Manchester in 1842, during the discussion of Mr. Fairbairn's report on the combustion of coal and the prevention of smoke, Capt. Taylor, of Cornwall, spoke as follows: He referred to the statement in Mr. Fairbairn's report that the average consumption of coal in Manchester was $10\frac{1}{2}$ pounds per horse-power per hour, while in Cornwall it was only $2\frac{1}{2}$ pounds. Although in Cornwall they had none of those ingenious devices for burning smoke, they allowed very little to escape, and made 1 pound of coal do as much as 4 pounds were made to do in Manchester. In the parish of Guennap there were twenty-five chimneys, of which he had eighteen himself, and not a particle of smoke could be seen. All the engines were, besides, of a very large power, but the boiler space was greater and more care was taken in the firing. As to patents for coking the coal, that had been the duty of every careful fireman in Cornwall for the last twenty years. It was, however, to be observed that the kind of work done by the engines was of such a nature that the amount done with a given quantity of coal could readily be ascertained. In consequence of this, the system had been introduced of weighing out the coal regularly to the firemen, and the duty of the engines was reported every week, and at some mines every day. This produced, simultaneously, an emulation among the engine makers, the proprietors and the workmen, each of whom was ashamed of being outdone by his neighbors; and from their joint care and exertions, and most especially that of the firemen, resulted that extraordinary economy for which Cornish engines are so justly famed. The plan followed was to keep their fires bright, coking the coal in front, and when sufficient boiler space was given, the proper management insured, no smoke-consuming patents were necessary; and he felt fully persuaded that if the proprietors of steam engines in Manchester would attend to the Cornish principle, they would find their smoke consumed and much gross waste of fuel prevented.

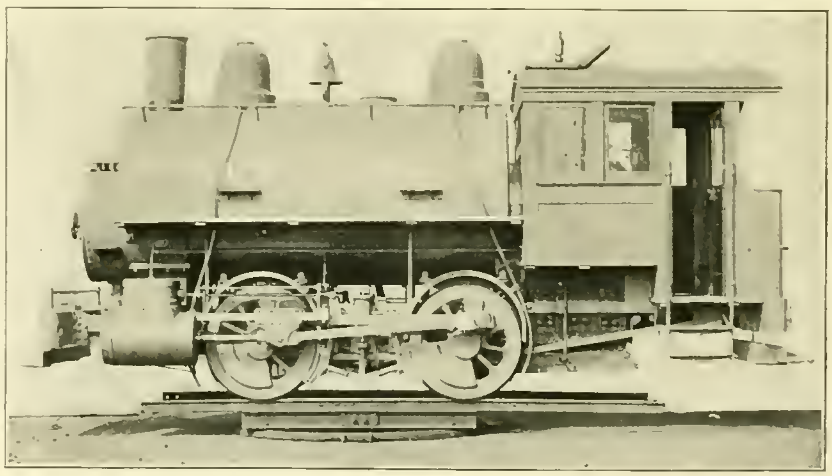
Tempering Springs and Tools.

Among other interesting things shown me by Mr. E. P. Fitzgerald, the foreman blacksmith at the Springfield shop of the Boston & Maine Railroad, was his method of tempering. This as much as anything showed him to be a careful, thoughtful mechanic, and his work in this line is extremely interesting.

They had been having trouble breaking the springs used in holding metallic packing rings in place, and he experimented to find a remedy. With ordinary tempering they would either be hard enough to break or just soft enough to retain a slight set after being compressed. Both were bad, but the happy medium seemed to keep just out of reach.

Then he tried the oil bath and thermometer, and began experimenting. He put a crucible of linseed oil over a forge fire and heated it to the desired point, testing with a thermometer which reads to 700 degrees Fahr.

After considerable experimenting, he found that with Howe, Brown & Co. spring steel a temperature of 610 degrees gave the best results. This is also an average for other steels, this merely being the kind he was using. As soon as the oil reaches this temperature he takes the crucible from the fire and lets it cool down as it will. In testing the springs he put them under a steam hammer and held them closed down together for thirty-six hours. At this temperature of the oil they showed no set and have given satisfaction in service.



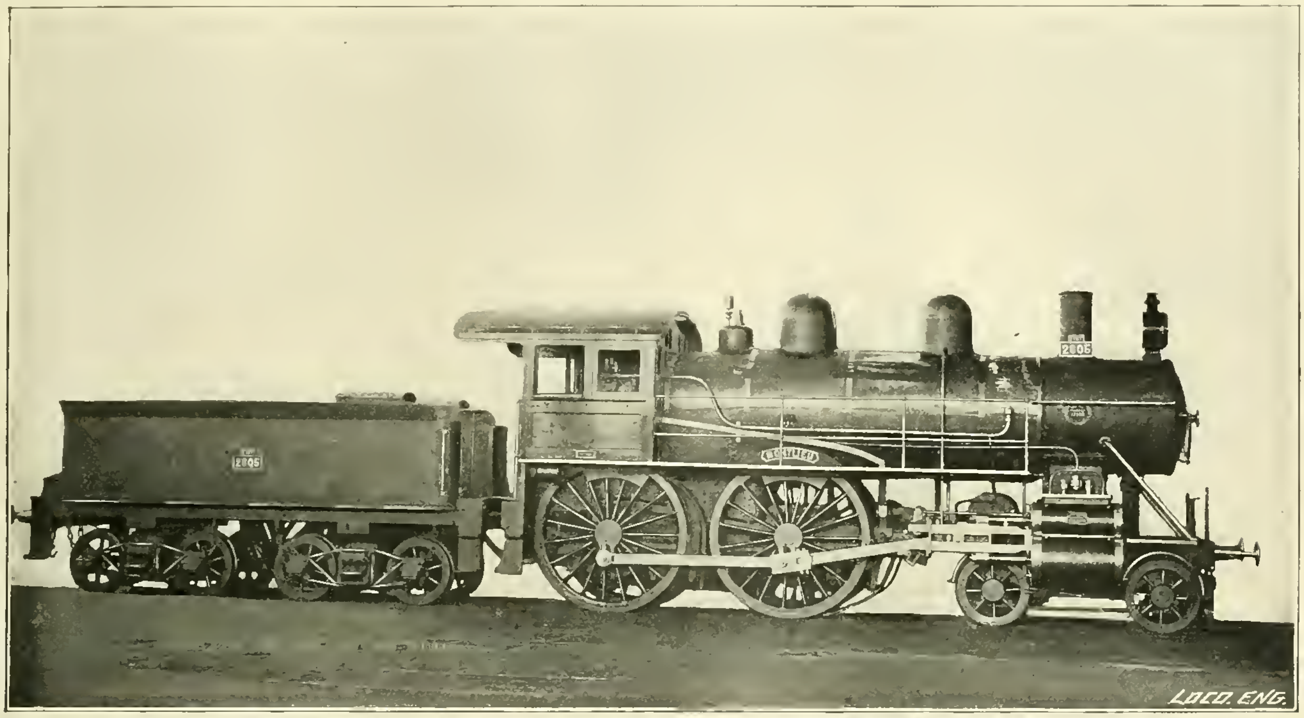
A HEAVY SWITCHER. H. K. PORTER COMPANY.

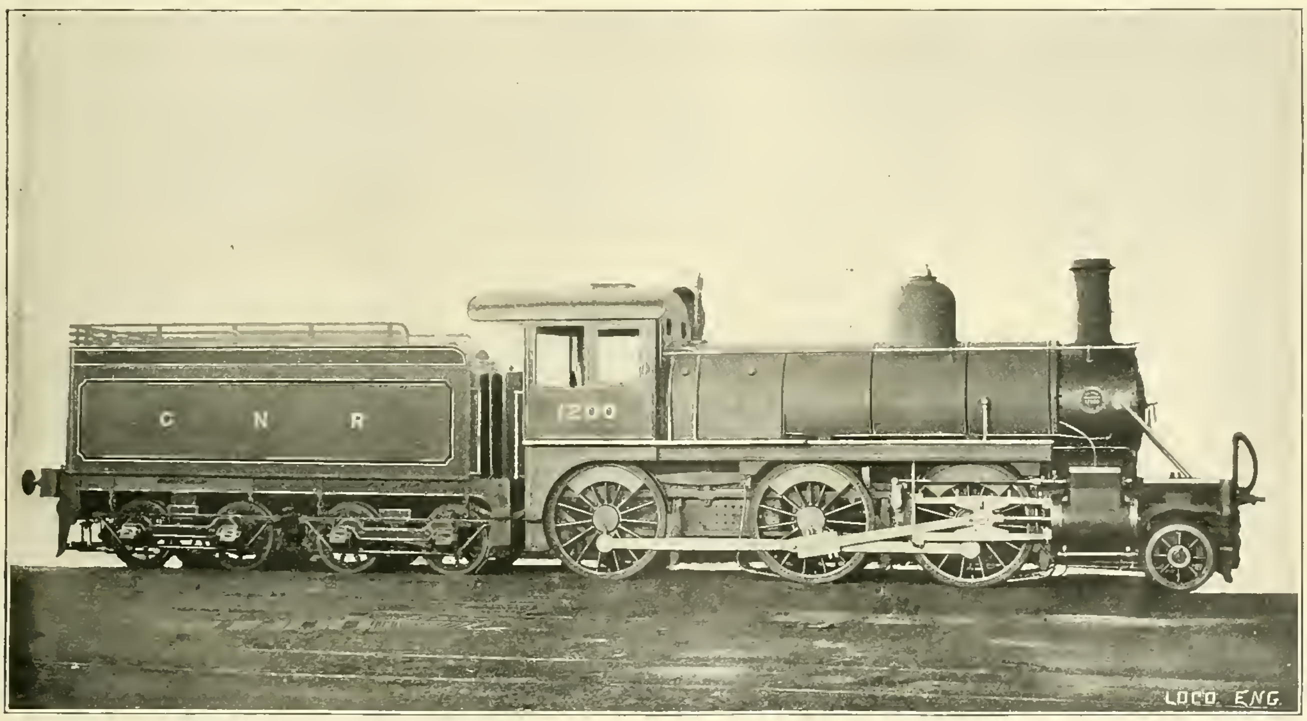
He also uses this in tempering such tools as taps and dies, and finds that a temperature of from 400 to 425 degrees gives good results. Mr. Fitzgerald says this thermometer costs about $3.50, but that it is worth ten times that amount to know what you are doing in the tempering line. C.

Baldwin Engines for Paris Exhibition.

The two engines here shown form the exhibit of European locomotives to be shown by the Baldwin Locomotive Works at the Paris Exposition. They both appear to be particularly well designed engines, and we have no doubt but what they will make a creditable showing for American builders when they get to work on the railroads for which they are built, viz.: the Great Northern Railway of England and the State Railways of France.

The cylinders of the Great Northern engine are 18 x 24 inches, and the driving wheels 61½ inches outside diameter. The boiler pressure to be carried is 175 pounds per square inch. According to our usual method of calculating the tractive power, these engines will develop about 18,000 pounds turning effort upon the driving wheel. The boiler is 54¾ inches diameter at the smallest ring, and with the area of firebox and tubes, provides 1,380 square feet of heating surface. The grate is 16.7 square feet. The firebox is made of copper and is 72 inches long, 33¼ inches wide and 75½ inches deep. There are 254 tubes, 1½ inches in diameter and 10 feet 11¾ inches long. The driving axle journals are 7 x 8 inches and the engine truck journals 5 x 8 inches. The driving wheel base is 14 feet 9 inches, and the total 22 feet 8 inches.



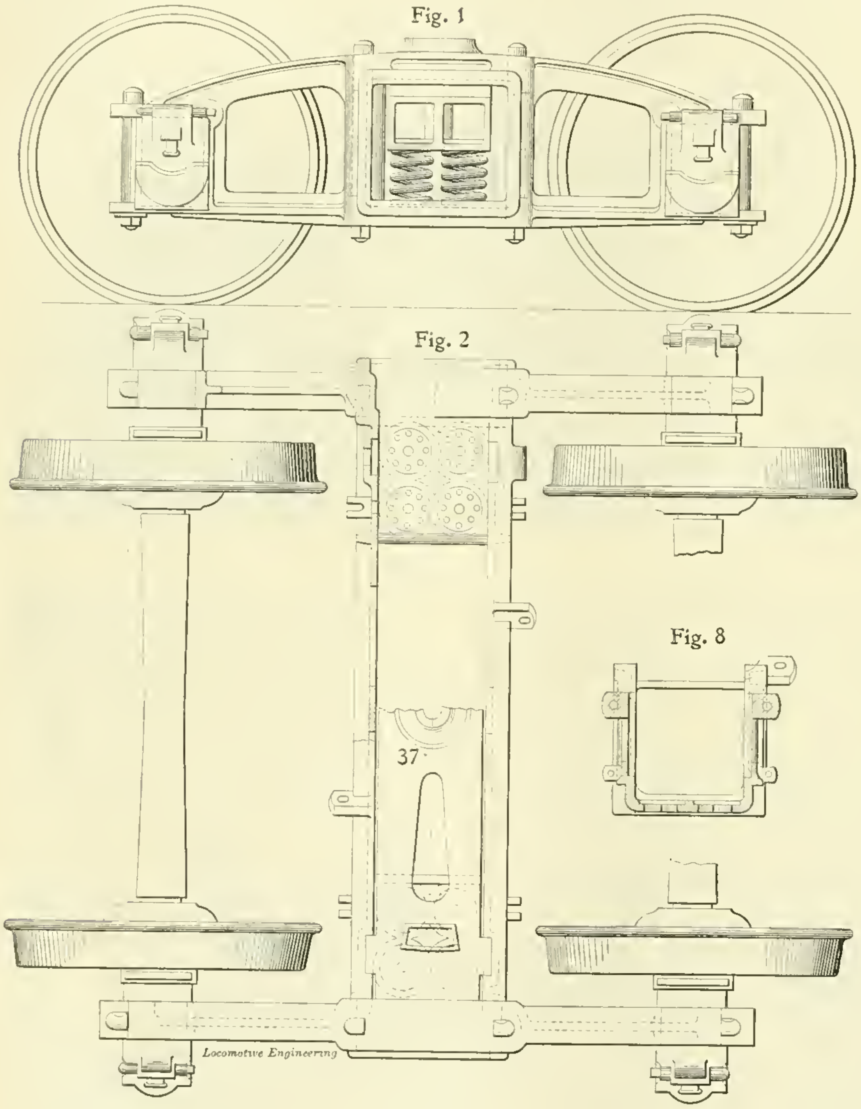


BALDWIN LOCOMOTIVES FOR PARIS EXPOSITION.

As will be noticed from an examination of the engraving, the engine for the French State Railways is the Vauclain compound type. The cylinders are 13 and 22 inches in diameter, with 26 inches stroke. The driving wheels are 84¼ inches in diameter and the boiler carries 215 pounds per square inch working pressure. These figures will show that the tractive power of the engine is about 20,000 pounds. The boiler is 56⅝ inches in diameter at the smallest ring. There are 282 2-inch tubes 12 feet 1 inch long. There are 128.4 square feet of heating surface in the firebox, 1,764.2 in the tubes, a total of 1,892.6 square feet. The grate area is 25.58 square feet. This will be found to be a much more liberal heating surface than what European locomotives of small cylinder capacity are usually provided with. The firebox is of copper, 88¼ inches long, 43¾ inches wide and a mean depth of 65 inches. The journals of the driving axles are 8 x 10 inches and of the engine truck wheels 6 x 10. The driving wheel base is 8 feet, and the total 23 feet 6 inches. The wheel base of engine and tender is 48 feet 7½ inches. The total weight of the engine is 117,985 pounds, of which 69,760 pounds are on the drivers and 48,225 pounds on the truck. The engines are unusually well finished, although they will look plain beside the decorated locomotives of continental Europe.

Symons Boltless Cast Steel Truck.

The tendency of late years has been towards simplicity of form in the designing of railroad machinery. Much attention is being devoted to making the number of parts as few as possible, a practice which works very well in keeping down the cost of repairs. If there is any part about a car which ought to be made as simple as possible it is the truck, but in many instances it has not received the care from the designer that its importance deserved. Among the superintendents of motive power who are properly impressed with



W. E. SYMONS' CAST STEEL TRUCK.

the advantages of simplicity in car trucks Mr. W. E. Symons, of the Plant system, holds a conspicuous place. The repair yard has long been one of his favorite lingering places, and there he was always absorbing object lessons about lines of weakness that tend to send cars to the repair yard before their time.

The inspiraton of this experience sent Mr. Symons to scheming on the design of a truck to have the fewest possible number of parts, and the truck shown on this and the next page has been the result. The design of the truck is so clearly shown in the engravings that it will be understood without any description, but we give a few lines written about it by Mr. Symons in a letter to the writer. He says:

"Agreeable to our conversation when in your office a few days ago, I send you herewith a large print of the boltless cast steel freight car truck, a small print of which I left in your hands.

"This truck, as you will note, is composed of three members—the side, or arch bar member, and the cross bar, or transom, member, the fastening being at the point where column bolts are usually placed, but in their stead we have used a tapered key, which not only has about 30 per cent. more bearing surface than the ordinary column bolts, but will, in my judgment, tighten itself by gravity to compensate for any wear, while the ordinary bolt will continually get looser from the same cause.

"The only fitting I anticipate having to do in the first set is where the cross member slips into the side members, which is shown on the detailed drawing. I expect however, that after some experience is had in making them that we will be able to cast these parts sufficiently accurate so that we can join them together without any machine work. I figure this truck out to only weigh about 1,200 pounds, which is less than any of the other metal trucks which I know of as being on the market, and as there are only eight movable pieces to be used in joining it together, including the journal fastenings, I think it would be a decided improvement over any of the metal trucks we now have.

"Patents are pending on this and another one of similar design, patterns have been made, and I expect in a short time to have some of them in service, after which I can report results."

A New Union.

The A. E. Dart Union Company, of Woburn, Mass., are putting a new pipe union on the market. The special feature is that it uses any good sheet packing or metal packing if desired.

By a ball joint arrangement of the flange it is possible to make a tight joint even if the pipes are not in line—in fact, it is claimed they can be 10 degrees out of line and be made tight. They are made of steel castings and are quite heavy, having octagonal ends so a wrench can be used.

At the request of the Hon. James Wilson, Secretary of Agriculture, Angus Sinclair has written a long article on "Development of Transportation," to be published in a Year Book that the Government is preparing. The book will be circulated in the Paris Exposition. Its purpose is to disseminate information about the natural resources of the United States.

Chicago and Grand Trunk Notes.

The Chicago & Grand Trunk Railway have just completed a new brick roundhouse of thirty stalls at the Tunnel Yards, near Port Huron, and began using it January 30. Each stall has a pit 50 feet long, with brick sides and concrete bottom, heated with coils of 1-inch steam pipes the full length of the pits. It is a little over 76 feet from the doors across the house to the other outside wall, so the longest engines can be housed and have plenty of room to get around them. The big St. Clair tunnel engines are housed and cared for here.

Two lines of 2-inch pipe pass entirely around the house next the roof, one line for live steam, the other for compressed air, with pipes down the posts between every two pits. Two lines of 4-inch water pipe also pass clear around the house overhead, one line for hot water for washing out and filling up, the other line for cold water. A pressure of 100 pounds is maintained steadily in these water pipes. Drop pipes, 2½ inches in diameter, lead down to the wash-out hydrants. In the side of each pit there is a pipe connection, which the blow-off cock can be coupled to, the water from the boilers is blown out into a hot water receiver or underground tank of very large size. This hot water is used for washing out boilers, being handled by one side of a large Worthington duplex pump; cold water is handled by the other side of the pump. Two tubular boilers, 5 feet in diameter by 16 feet long, furnish steam for the entire plant at 125 pounds per inch. The dynamo and air compressor are in the boiler house. The entire plant is lit with incandescent lights. The copper wires for the electric lights are encased in a ¾-inch pipe all over the engine house.

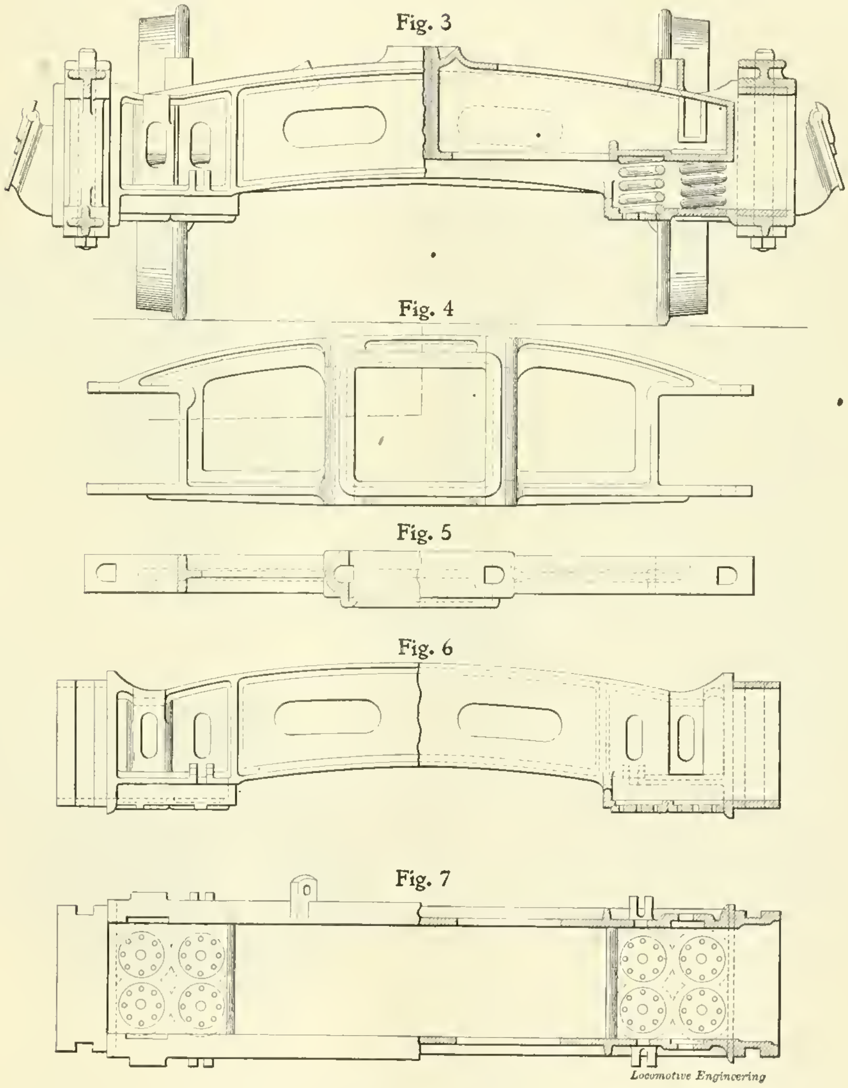
The foreman's office, storeroom and enginemen's waiting room are in a separate building, 75 x 22 feet.

When the engines come from their trains they come by the coal chute, which has thirty-two pockets, take coal, then get sand from an overhead bin, then to the cinder pit, of which there are two side by side, with a track between them for the cinder gondolas, then across the table, a 70-foot one, built by the Detroit Bridge and Iron Works, and on into the house. When they go out to their trains they pass out on another track, and are not held by the incoming engines. The cinder pits have a bar of iron 4 inches by 1 inch on each side near the top, supported by brackets, which makes a railway on which the ash buckets are moved along to the center of the pit, where an air hoist lifts the buckets of ashes up over the gondolas and they are dumped. The cinder hoist extends over both cinder pits.

The cars of coal are drawn up on the coal chute with a cable passing over pulleys at the end of the building and attached to a locomotive on the tracks below; four cars can be pulled up at once. In the end of the coal chute is located the sand house, with drier on the ground floor. From there the sand is elevated to the bins above with air pressure. The storage bins for the fresh sand hold about 800 yards—quite a supply.

In the way of running repairs there will be enough machinery to do considerable light work. There is one drop pit which will take out a pair of drivers or truck wheels.

As this is the terminus of the Eastern division and the Detroit division, a large number of engines will be handled here daily. The old roundhouse at Fort Gratoit, of nineteen pits, will now be used for a repair shop.



DETAILS OF SYMONS' CAST STEEL TRUCK.

A Joke on the Conductor.

They have been having some fun with one of the old conductors on one of the branches of the New Haven road over his watch. They report watches and compare for accuracy, the report being entered in a "watch" book.

Mr. Winters—we'll call him—is very proud of his watch, which has a remarkably good record. Not long ago he marked it down as being two seconds slow, and some irreverent chap went him one better by putting another 2 in front of it. Winters discovered this and raised Cain over a record of twenty-two seconds.

Nobody did it, but everybody knew of it, as is usual in such cases. The next day a lot of regular riders—mill girls—kicked to one of the conductors for going off without them the day before. They knew the train was ahead of time, because they had set their watches by Mr. Winters' time, and that was always right.

This was too good a chance to miss, and so the other conductor, with a stronger love for humor than veracity, told them that Winters' watch was just out of the pawnshop and had been twenty-two seconds slow the day before.

Now Winters is looking for the man who changed his record, and he also has it in for the second defamer of his watch.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

New Air-Brake Instruction Cars.

The International Correspondence Schools, of Scranton, Pa., have just finished the floor plan and specifications for some new air-brake instruction cars to use in connection with the railway department.

These cars are to be 70 feet long over end sills, 78 feet 6 inches long over all, and 9 feet 8 inches wide over side sills. The instruction room will be 36 feet long, and will have fifty sets of freight brakes, twenty-five sets arranged on each side, with the class room in the middle between them. The piping for this train will be the same amount as is actually used in a fifty-car train, and will be located under the body of the car. Fifteen cars of air signal line pipe will be located in the clear story next the upper deck. At the end of the instruction room will be located driver, tender and passenger car brakes and a full set of high-speed equipment, with sectional valves of each kind, tandem triple valves, etc. The car will be arranged to show double heading with separate brake valves and main reservoirs.

The total main reservoir capacity will be 54,000 cubic inches, in three main reservoirs, so arranged and coupled together that 16,500 cubic inches can be used to show how a small main reservoir handles a long train, or 33,000 cubic inches, or the whole 54,000 cubic inches may be had. The water raising system will be applied to the car so it can be used for instruction purposes. The water supply for the boiler will be in a tank under the car. The boiler, air pumps, the dynamo and its engine, the feed pump and Baker heater will be located in the opposite end from the instruction room, and be away from the noise and heat of the boiler and pumps. As the force of men employed on the car will sleep and eat there, accommodations are provided. The kitchen, dining room and office will be between the boiler room and instruction room.

Three of these cars are to be built, one of them as soon as possible, and will run over the railroads where the school has contracts to instruct the men. They will follow the same routes that the instruction cars now in service with the stereopticon courses have done, and give the students of the school a chance to thoroughly perfect themselves in a knowledge of the air brake. These cars are to be lighted at night with electric light. The Westinghouse Engine Company will furnish the boiler, engine and dynamo, and the Westinghouse Air Brake Company will furnish the air-brake equipment.

These cars are intended to be as complete as possible, and no expense will be spared to make them so.

The First Automatic Air Brake.

The first automatic brake was experimentally introduced in October, 1872, and was applied to the train known as the "Walls Accommodation," running between Walls Station and Pittsburgh.

Although the straight air brake had been giving excellent satisfaction and wonderful service, Mr. Westinghouse

LEVI CLOSE.

JOHN RAUTH.

early discovered the importance of having a safety brake which, while doing its ordinary work, would give notice and stop the train should anything happen to the brake to put it out of order. It was on this basis, then, that Mr. Westinghouse designed the automatic brake.

While the automatic brake on the "Walls Accommodation" was being tested, the new automatic attachment was being discussed much by the railroads, many of whom took steps to place it upon their cars. A series of interesting tests of the improved attachment was held on the Eastern Railroad, in Boston, in April, 1873, and made such a good impression that many of the roads started in immediately to equip their trains with the new brake. About this time, the vacuum brake was struggling hard in its efforts to become the leading power brake, and many interesting and exciting competitive trials were made between the vacuum brake and the Westinghouse automatic.

The engineer who ran the first automatic brake was Levi Close, whose photograph accompanies this article. John Rauth was the conductor. Mr. Close ran the experimental train for nearly six months before the above mentioned trials were made, and took his train to Philadelphia for exhibition trials in May, 1873. The train consisted of seven passenger cars and engine No. 45, Altoona build, Class C. Here trials were held before a large committee of the Franklin Institute and a large gathering of railway officials—nearly 100 persons altogether.

The tests consisted of getting the train up to speed, when a flag was thrown from the cab window and the brakes applied, therewith, simultaneously, the time of stop and distance being taken.

In the first test, the train was severed while running at a speed of 32 miles an hour and the stop was made in 11 seconds time and 367 feet. Next, the engine was severed from the train and given steam while running at 45 miles an hour, and a remarkable stop of the cars was made in 10 seconds and 318 feet. So wonderful did the committee think this stop that they requested Mr. Westinghouse to repeat the experiment, which he gladly did.

From this on, the success of the automatic brake was assured, and finally displaced the straight air brake and vacuum forms.

Some Early Competitive Brake Trials.

In the summer of 1873 the railroads of New England were about equally divided as to the superiority of the vacuum and compressed-air brake. Some had equipped with one and some with the other. Unsuccessful efforts had been made to bring about a series of tests between the two forms of brakes, to demonstrate superiority, and in June of that year, while the Master Car Builders were in session at Boston, arrangements were made to hold the long-desired test.

The 14-mile stretch between Reading and Lawrence, on the Boston & Maine Railroad, was selected as the running ground, and twelve coaches were used in each train. The trains ran side by side on double track. At 27 miles per hour the vacuum brake stopped its train in 20 seconds and 804 feet. The compressed-air (straight) brake required 26 seconds and 825 feet, the vacuum winning by 6 seconds and 21 feet.

In the next run of 32 miles per hour, the vacuum won again by 5 seconds and 25 feet.

At this stage of the tests, a train of nine cars arrived from the Eastern Railroad, fitted with the automatic air brakes. The Westinghouse representatives had unsuccessfully endeavored to get this train to the scene in time to enter it, instead of the straight-air train, against the vacuum train. The vacuum train was now reduced to nine cars, and similar tests were made as with the straight air brake.

At 28 miles per hour the Westinghouse automatic stopped in 13 seconds, and the vacuum in 22 seconds, the automatic winning by 9 seconds and 315 feet. At 32 miles per hour the Westinghouse automatic stopped in 6 seconds less time and 265 feet less space. At this stage of the proceedings the victory of the compressed-air brake was so pronounced that the vacuum train was entirely withdrawn from the contest. Thus the superiority of the Westinghouse automatic brake over the vacuum was so satisfactorily demonstrated to this body of railroad men that the equipment of cars with the automatic brake went rapidly forward.

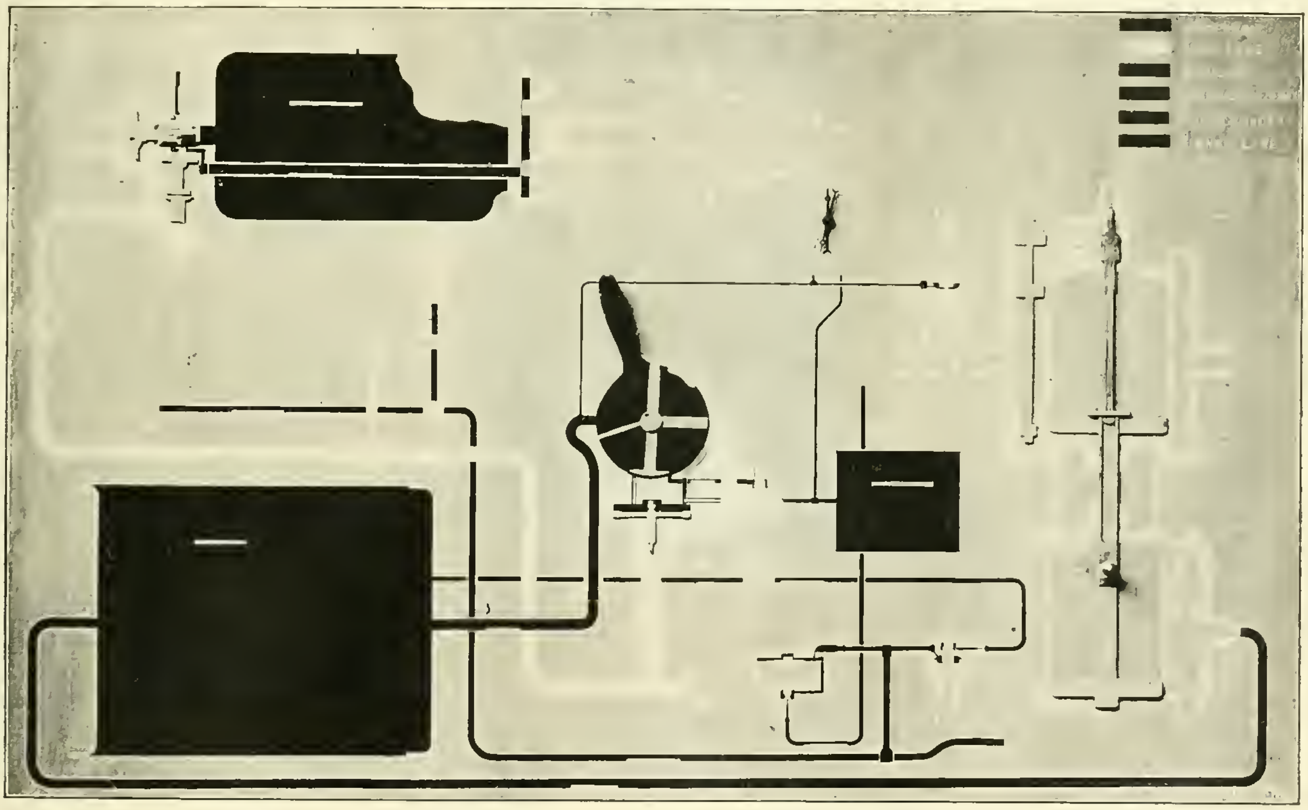
After many delays we have got our new plate ready showing all the parts of the American locomotive. Price 25 cents.

Air Brake Chart.

Mr. H. C. Ettinger, air-brake instructor, and Mr. P. Lofy, a foreman in the Wabash shop at Springfield, Ill., have designed and built an air-brake chart, which is a valuable device for an instruction room.

The chart is mounted on a sheet of aluminum, to make it portable, and has a substantial frame around it. The outside size is 42 x 30 inches; the back part of the chart is boxed in to protect the levers and connections which operate the various movable parts of the equipment. The complete chart weighs 60 pounds.

This chart shows the various pipes and parts of an air brake on an engine and one car, including the signal equipment, and is colored to show the various airs like Mr. Desoe's chart, now issued by Locomotive Engineering.



AIR-BRAKE CHART.

In addition to showing all the equipment on the chart, the movable parts of the air pump, brake valve, duplex gage and quick action triple valve are made of sheet brass and attached by rivets moving in slotted openings in the sheet of aluminum. These parts can be moved on the chart the same as the parts of a sectional valve or pump to show the actual operations. The illustration shows an 8-inch pump, but the 9½-inch pump can be put on as easily as the 8-inch.

The piston of the air pump when moved up and down shifts the reversing rod and valve, and that in its turn moves the reversing piston and main steam valve, showing the position of the valves at any part of the stroke of the pump. The brake valve, when operated in service position, moves the equalizing piston. If placed in the emergency position it remains seated, as shown in the illustration. The black hand of the duplex gage drops back a few pounds with a service application at the brake valve, and falls to 0 with an emergency application. The parts of the quick action triple valve also follow the movements of the brake valve for service and emergency applications.

These movements of the equalizing piston, gage and quick action triple valve are made by a set of rods, levers and bell cranks which are connected to the rotary valve and located out of sight on the back of the chart. All the movable parts respond to the motion of the rotary, except the pump, which has the piston moved by hand and the other parts connected to the piston.

With this chart an instructor can take a class through the course of the equipment. It serves both as a chart and a set of sectional valves combined in one. It would be very handy in a lodge room or in a reading room where men interested in the study of the automatic brake are gathered.

We understand the device will be patented and manufactured for sale later on. The expense will be moderate.

It is reported that nearly one thousand old employés of the Pennsylvania Railroad have been retired by the new pension plan.

CORRESPONDENCE.

Peculiar "Jammer Brake" Action.

Editor:

One of our passenger engines, having practically new tires on her 80 inches of wheel, had a peculiar accident happen the other night.

When nearly 70 miles out it was discovered that the tires on one side of the engine had loosened and moved in as far as the firebox and frame would permit. The cam type of driver brake was found to be up very tight on this side, although known to have been adjusted to 2 inches piston travel before starting. The track was in first-class shape also, so no roughness of track would cause binding. The second trip after this, while greater watchfulness was being exercised, the brake-shoes were set at 2½-inch travel before starting, the shoes were found to be getting closer and closer to the wheels, and a stop had to be made going each way to let out the slack.

It was discovered that the set screws in the cam nuts had broken off inside the arms and one of the cam screws would work up, due to the jar of the engine (or some other cause not known), and lengthen out the arms, thus causing the shoes to bind and heat the tires. The shoes were redhot. We were unable to account for the cause of the tires loosening until this later trip's experience seemed to prove it.

In my experience of several years I have never before seen nuts or screws automatically *tighten* themselves—it is quite often otherwise. As soon as we find out how to stop this action at just the right point, we are going to patent it for an automatic slack adjuster. In the meantime any other roads are privileged to use it without infringement.

E. W. Pratt,
Genl. A.-B. Insp., C. & N. W. Ry.
Chicago, Ill.

Air-Brake Testing Device for Yard.

Editor:

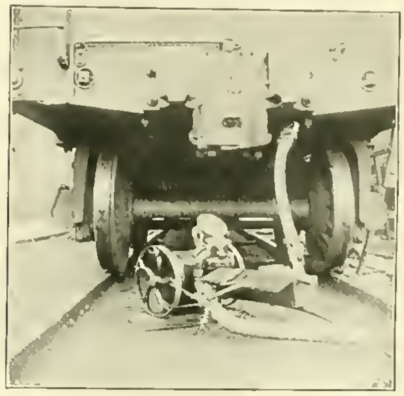
In yard testing plants it is imperative that trains shall be tested with an equalizing discharge valve under precisely the same conditions that may exist on the road in service, in order to determine what is the actual condition of the brakes in that train and develop any defects that may exist, such as neglected or defective triples, or the presence of triples in the train of different manufacture that may not work in harmony.

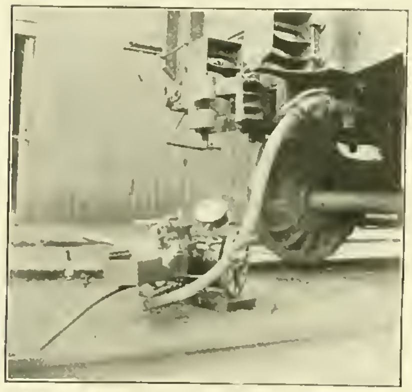
A train charged up in the yard and brakes applied by opening a cock, might work all right apparently, but the same train, when brakes were applied from an equalizing discharge valve might give very different results.

The wheelbarrow form of testing device in common use, having a brake valve, equalizing reservoir and gage, gives a satisfactory test, but is too heavy and cumbersome for use in crowded yards, and very frequently cannot be used on that account.

I send herewith a photograph of a device that I have used on the Chicago & Erie Railroad with good results, and it answers all requirements.

It consists of an equalizing reservoir





AIR-BRAKE TESTING DEVICES FOR YARD.

with an axle through it, a handle made of ½-inch pipe, two small wheels, a "D 8" brake valve, a Duplex gage and two hose connections, all of which are connected up as closely as possible, thus containing all the essential features in the most compact and convenient form, all unnecessary weight being eliminated.

It can be handled easily in crowded yards, pushed or pulled between cars or under low furniture and carriage cars where it would be impossible to take the wheelbarrow; in fact, a man can take it anywhere, for it can be picked up and carried bodily with one hand, if necessary.

In making a shop test of brakes on cars undergoing repairs the value of an equalizing brake valve cannot be overestimated in detecting and locating defects that may exist which would not be noticeable when brake was applied by opening a cock.

The tool box on the handle contains a combination wrench, a tool for cleaning out the grooves in hose couplings to receive new gaskets, a hammer and chisel, a small wrench for taking triples apart, and a few gaskets of different kinds.

The box may be used or left off as one may prefer, but with what tools can be carried in this box a man is prepared to do any light repairs that may be required.

Harry Orchard,
Chicago & Erie R. R.
Huntington, Ind.

"Kicking Off" Brakes.

Editor:

I notice in the last report of the Traveling Engineers' convention that the practice of kicking off the head brakes, when an engineer sees that he is going to stop too soon, is advocated by some of the members.

This, in my opinion, is poor practice, especially with long freight trains on heavy grades, as it is liable to result in breaking in two. We only permit this practice here when an engineer wishes to take the slack with the air.

The method we try to enforce here in making station or water tank stops with trains that are too heavy to be backed up in case an engineer runs by is, when the engineer, after making a service application, sees that he is going to stop too soon he puts his valve in running position, thus slowly increasing his train line pressure. The brakes having the longest piston travel, being equalized at the lowest pressure, will necessarily release first. The chances are 50 to 1 that these cars are scattered through the train, and not all on one end; consequently in releasing there is no jar or shock to the train. When enough brakes have released so the engineer knows that his train will run up to or a little beyond the objective stopping point, he puts his valve on lap again and makes his next application from there.

We have found this plan to work much better than that, so commonly used, of making either a full release, or kicking off the head brakes.

F. P. Roesch,
T. E., C. & S. Ry.
Denver, Colo.

Calling on Nature to Assist.

Editor:

A year ago or so there appeared in your columns a comment on the amount of space required by a French-speaking instructor to move his arms in while instructing on air brakes.

Well, I am that man. I do not wish to defend the manner of instructing, but to show the results secured to your readers of the air-brake columns, as follows:

During one of the cold nights of last week, one of our up-to-date air-brake engineers, while pulling a heavy freight, broke away from the train. The hose couplings being frozen, the strain was too much for the train pipe where it screws into drain cup, and it broke off. This did not daunt this engineer of this cold country. The cold was his best friend, for he wrapped up the broken train pipe with waste after securing it firmly to the drain cup and threw water on it until the whole was a mass of ice. He then charged up his train and brought the train in with all brakes working, twenty-three in number. This engineer can talk some English, but he can also talk French.

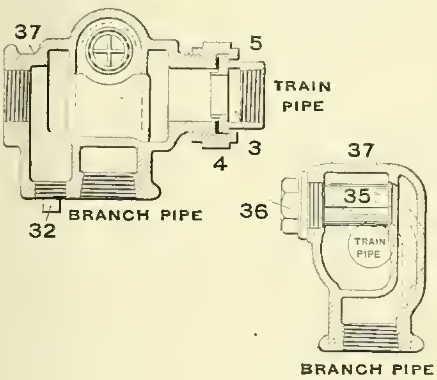
W. H. Rougeau,
A.-B. Inst., Intercolonial Ry.
Riviere du Loup, Quebec.

Train Pipe Strainer and Drain Cup.

Editor:

At the latest convention of the Air-Brake Association I believe some reference was made to the pipe strainer, and the need of a better location and of some means to facilitate its removal for cleaning and inspection, was brought to the attention of the members.

The train pipe strainer has not been given the attention its importance demands, and many of the slow-acting brakes, on our freight cars especially, are caused by dirty and neglected pipe strainers.



TRAIN PIPE STRAINER.

Our road recently purchased a number of new freight engines and cars, equipped with the New York air brake, and I am sending you a cut of the pipe strainer used with that equipment.

Referring to the figure, No. 1 is a longitudinal section through the drain-cup and strainer, and No. 1 is a cross-section showing the position of the strainer above the highest point in the train pipe.

In Fig. 1 the union of train pipe and drain-cup is shown—pipe, union nut and gasket being indicated by 3, 4 and 5, respectively, and the drain-plug by 32.

In Fig. 2 the strainer is marked 35, and nut 36 is extended on the inside of the casing to hold the strainer in position.

To clean the strainer, all that is necessary to do is to unscrew nut 36, and the strainer will come out with it.

The advantages of this arrangement of strainer and drain-cup are numerous:

First—The air must pass upward to go to the branch pipe, all dirt and foreign matter being caught on the under side of the strainer and having a tendency to fall back into the train pipe with each application of the brake.

Second—All heavy dirt or missiles that may be violently blown through the train pipe in cleaning or blowing them out, does not touch the strainer, on account of its position.

Third—It does not stop up easily, and if it should, it requires but a moment to remove, clean and replace it, there being no pipe joint to break to get at it.

Fourth—Triple valves are better protected and do not require cleaning so often; and the sluggish action of brakes, and sometimes their failure to act at all, is in a great measure prevented.

I have examined several triples to ascertain their condition, where this style of strainer is used, and in each instance have found them remarkably free from dirt.

In order to determine just how efficient this form of drain cup is in preventing dirt from accumulating in the triple and its strainer, I have blown out all scale and dirt in the train pipe on a particular car, and have determined to allow it to run until the triple actually needs cleaning.

J. P. Kelly,
A.-B. Insp. and Road Foreman of Engs.,
Chicago & Alton R. R.
Bloomington, Ill.

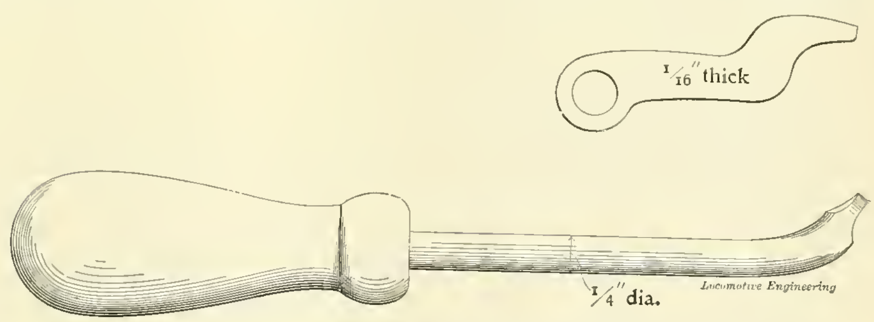
Tool for Cleaning Hose Gasket Grooves.

Editor:

One of the troubles with air-brake cars is leaky gaskets in hose couplings. This seems such an easy matter to remedy that on some roads trainmen are supplied with extra gaskets, and they make renewals while the train is under their charge. On account of the difficulty incident to getting the new gaskets into the coupling, owing to rust and parts of the old gasket not being removed, it is not unusual to find these gaskets whittled. This effectually spoils the new gasket, although the trainmen do not always discover it. The Westinghouse Air-Brake Company supplies inspectors with a handy tool for this purpose, of which I enclose you a sketch. This, however, is not a convenient tool for trainmen to carry. On the Burlington & Missouri Railroad I find trainmen are supplied with small flat tools, of which I send you sketch, and also enclose you sample, which you will observe can readily be applied to a trainman's bunch of keys, and would seem to supply the very thing that is needed without entailing any burden or inconvenience in carrying the tool. There is no patent on the tool, and anyone is at liberty to use it.

Lincoln, Neb. G. W. Rhodes,
Asst. Gen. Supt., B. & M. Ry.

[The Westinghouse Air-Brake Company is now supplying a smaller and more convenient tool.—Ed.]



FOR CLEANING HOSE GASKET GROOVES.

Vent in Train Pipe Cocks.

Editor:

Why isn't a vent put in side of body of the train pipe cock, and one of corresponding size in key at right angles to the port to allow escape of the air that remains in the hose after shutting off the cocks?

When the cocks are open in service, the vents would be so placed that one in key would be on opposite side to that drilled in body of cock, but when cock is closed the vent in key would be open toward hose, and the air remaining in hose would pass out through this vent, the port in key and vent in body of cock.

I would think uncoupling hose with the air pressure in them has an injurious effect on the washer in the coupling, and is due, no doubt, to the leaks at this point.

Ruxton, Md. Robert Hooper.

[This vent port was used several years ago, but gave so much trouble from admitting sand which ground and cut the cock, causing it to leak badly, that the vent port was abandoned.—Ed.]

Special Air Brake Tools.

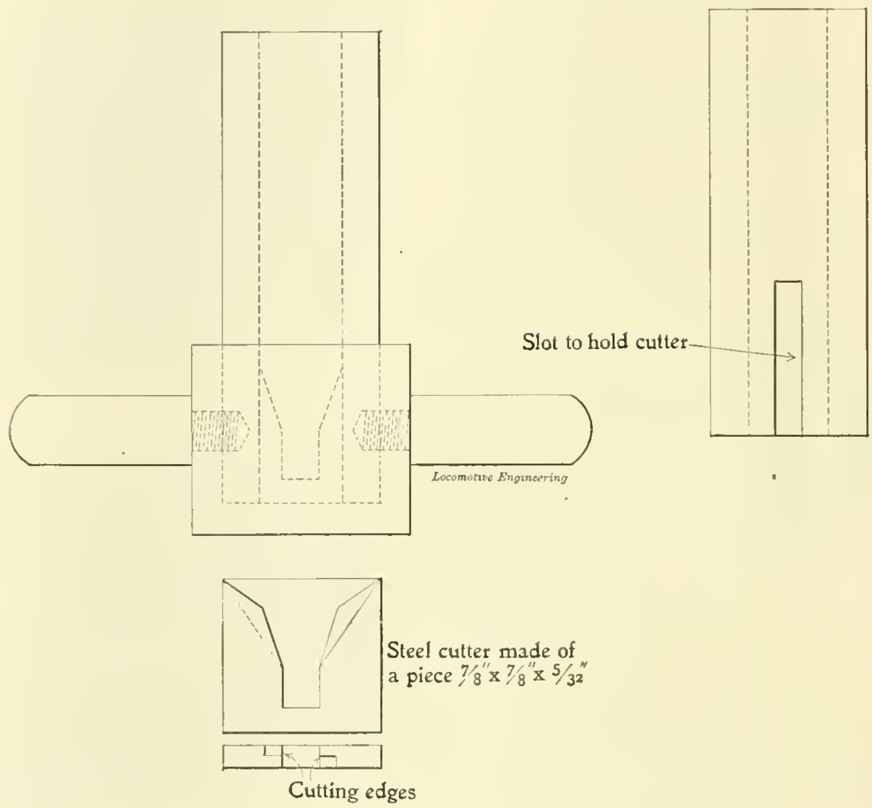
Editor:

I am sending you a sketch of a device for facing the seat of the equalizing piston. This seat, as you doubtless are aware, often gets damaged by coming down on some piece of scale or hard matter out of the pipes. I only designed this a few days ago, and I have had occasion to use it several times already. It comes in very handy when one is working in the roundhouse and lathes are at a premium. It is something after the style of a pencil sharpener.

We bore our 9½-inch pump cylinders right on the bench by hand, without taking off the intermediate casting, though we are going to put a countershaft to attach power. We can bore a cylinder this way in less time than we could break joints and take the cylinder to the lathe. This bar I have designed could be used with the pump on the engine.

We have also got a bar for boring the bush and cover that carries the main valve in the 9½-inch pump. We just place the top cover in the vise and attach the bar, which makes a good job in less time than the machinist would take looking for an angle plate. By use of a special jig we bore the small cover the same way, putting in a packing ring 1-32 inch larger. It makes a splendid job.

Winnipeg, Man. B. HARDY, C. P. R.



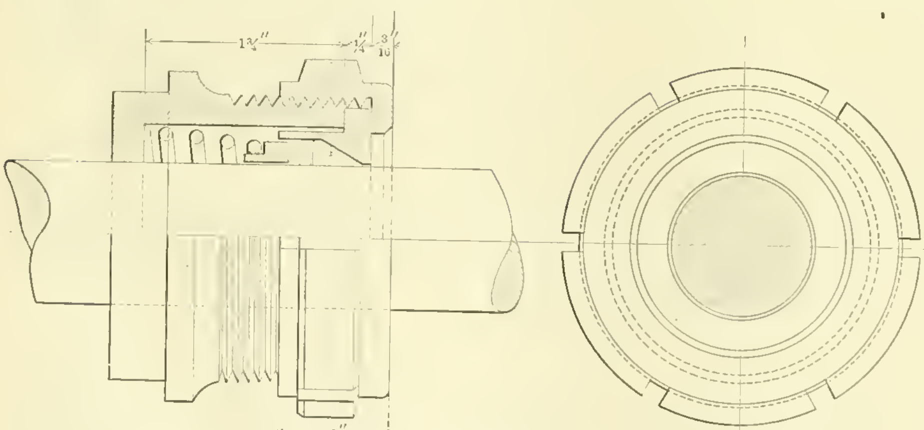
SEAT-FACING TOOL.

Metallic Packing for Air Pumps.

Editor:

The efficiency of the piston rod packing in air pumps is of great importance. It is therefore necessary to use a packing that will prevent as much leakage at stuffing box as possible; also such as can be conveniently removed and applied in case it is necessary to repack the pump while in service.

The adoption of metallic packing for air pumps has doubtless met with considerable opposition on account of the inconvenience experienced in applying new rings in case it is necessary to repack the pump while in service; especially on hot engines whose pump throttle may be leaking. The inclosed blueprint will clearly illustrate the Georgia Southern & Florida Railway's method of applying U. S. Metallic packing to 8-inch pumps. As will be seen from the print, the stuffing box has been bored to 1¾ inches deep, which reduces the tension of the spring considerably, thereby adding materially to the convenience in repacking as well as to the life of the rings.



U. S. METALLIC PACKING FOR AIR PUMP.

By shortening the nuts ¼ inch (1-16 inch on face, 3-16 at thread), an additional 5-16 inch can be had between nut and stuffing box when the former is slacked off, which is an important consideration in repacking. Increasing size of hole in center of nut to 1⅞ inches serves for a twofold purpose, viz.: First, for convenience in repacking; second, the bottom nut forms a cell into which oil can be fed from the piston rod cup in case one is used, thereby furnishing sufficient lubrication for the swab and rod.

For 9½-inch pumps boxes and nuts are bored proportionately deeper and larger. Some rods are supplied with an oil cup, while others are not, depending upon the disposition of engineers to feed sufficient oil through the lubricator to keep the rod lubricated.

We have some of this packing in 8-inch pumps that has been in very heavy locomotive passenger service for about three years, and gland nuts have never been slacked off, no rod cups being used.

Macon, Ga. THOS. S. BURTON.
Air-Brake Inspector, G. S. & F. R. R.

A Good Oil Record.

Editor:

In your Air Brake Department I have never seen anything in regard to how little oil can be used on an air pump. Now, I would like to give you an instance of what we have done. I say we, because the engine is double crewed.

I am running a Baldwin switcher in Fort Street Union Depot, doing the passenger work in Detroit. The pump is a 9½-inch Westinghouse, doing heavy work, charging empty passenger trains, and has not been stopped for twenty-four days and nights, and only used one-half pint of valve oil.

I don't think there is a finer working pump in service now. I am a firm believer that two-thirds of the air-pump defects come from using too much oil.

Detroit, Mich. C. L. STERLING.

A correspondent, one of the foremost air-brake men in the country, doubtless voices the sentiments of many other men in a recent communication in which he says: "The large-capacity main reservoir is of inestimable benefit, I think, to the pump, safety and smooth release."

April is the month, Tuesday is the day, the third is the date, the place is Jacksonville, Fla., and the event is the seventh annual convention of the Air-Brake Association. Make timely and proper application for transportation, viz.: at once, through your immediate officials.

The New England Air-Brake Club.

For five or six years past the air-brake men of the railway lines centering in Boston have contemplated the formation of an air-brake club. The club has at last materialized, Mr. J. L. Andrews, general air-brake inspector of the New York, New Haven & Hartford Railway, having issued an invitation to the air-brake men of neighboring lines to meet in his instruction car at Boston, January 10th. The invitation was liberally accepted, and the meeting resulted in the formation of "The New England Air-Brake Club." Mr. H. S. Kolseth was chosen president.

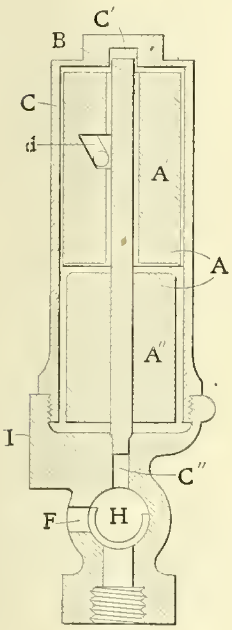


Fig. 1

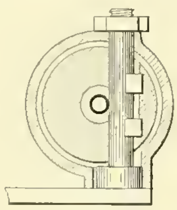


Fig. 2

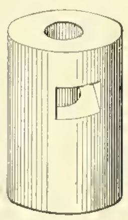


Fig. 3

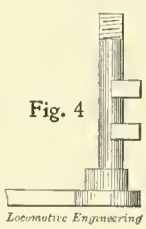


Fig. 4

KELLY RETAINING VALVE.

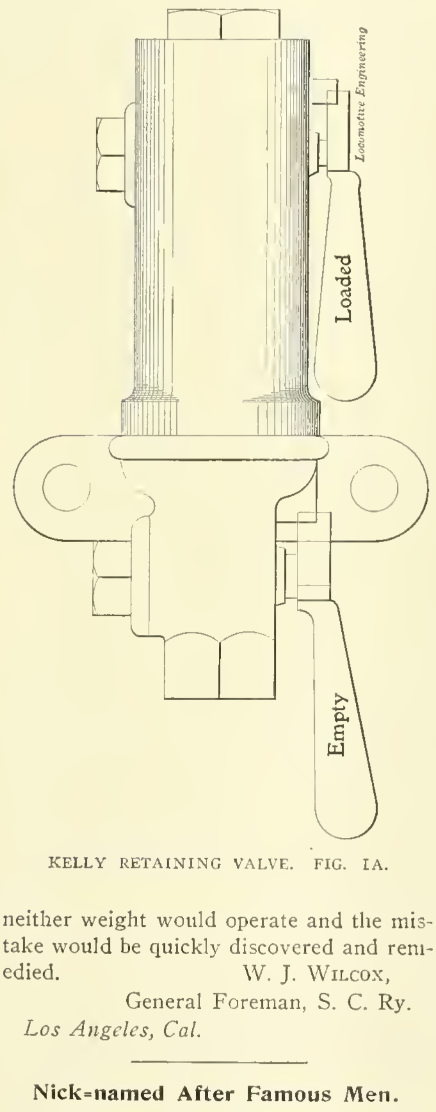
Nearly all the prominent air-brake men of that section are already members, and the remaining ones will doubtless join soon. The new club has our very best wishes for its success.

Double Weighted Retaining Valve.

Editor:

Am sending you accompanying drawings of a new retaining valve, designed by Mr. R. W. Kelly, one of our engineers which will doubtless prove interesting to your readers. An elongated top holding two weights is shown in Fig. 1. In the upper part of the case is mounted weight *A′*, and in the lower part is weight *A″*. Weight *A″*, when the lower handle is turned up, performs the same function that is now performed by the weight in the present retaining valve. When the car is loaded, weight *A′* is added to weight *A″* by turning up the upper handle, thereby retaining twice the pressure in the brake cylinder of the loaded car of that retained in the brake cylinder of an empty car.

It will be observed (Fig. 1) that the lugs which hold weight *A′* in its non-operative position are about 20 degrees off the perpendicular, and that the handle by which they are released and the weight *A′* both operate to prevent their releasing weight *A′* except by the direct action of the trainmen. The upper handle is plainly marked loaded, so that the trainmen cannot make a mistake, and if they should, unless the lower handle was also turned,



KELLY RETAINING VALVE. FIG. 1A.

neither weight would operate and the mistake would be quickly discovered and remedied.

W. J. Wilcox,
General Foreman, S. C. Ry.
Los Angeles, Cal.

Nick-named After Famous Men.

The engine and trainmen on the Pittsburgh & Lake Erie are a humorous set, and have wittily nicknamed some of their engines after prominent men. A mogul has been called "Aguinaldo" because it has been running a long time, puffs furiously and never accomplishes much. The best and swiftest engine is called "Dewey." Another one that hangs up on every hill it comes to has been nicknamed "Buller." A big consolidated that happened to be standing on the switch frog the other night when a runaway train of cars tried to get out on the main track, and which smashed or ditched the whole lot, has been dubbed "Joubert."

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(18) J. L. W., Chicago, Ill., asks:

With but 40 pounds of air, how much would have to be reduced to get full power obtainable? A.—About 20 pounds.

(19) L. S., Chadron, Neb., asks:

What proportion are the auxiliaries to the brake cylinders? A.—The auxiliary reservoirs have about four or five times the cubic capacity of the brake cylinders.

(20) O. P. D., Cleveland, O., asks.

What is the quick-release valve mentioned in the November number of Locomotive Engineering? A.—Please note the illustration and description of this device elsewhere in this department.

(21) R. & H., Mattoon, Ill., writes:

An E-6 valve is put up with a brake-valve reservoir holding 100 cubic inches more air than the regulation size; would there be a noticeable difference in the applying of this brake. A.—Yes. It would apply slower, of course.

(22) J. L. W., Chicago, Ill., asks:

How can shoes be kept from rubbing against tires continually on eight-wheel engines? A.—They may be kept off by light adjusting springs, or by being so suspended that when air is released from the brake cylinder, the shoes will drop away from the wheels by gravity. The latter is the preferable method.

(23) J. L. W., Chicago, Ill., asks:

What is the proper brake piston travel on truck brakes, such as are on the large engines? Also, how is the slack taken up? A.—About 4 or 5 inches. The slack is taken up on the screw in the bottom connecting rod, or with the automatic slack-adjuster with which nearly all modern engines are now being equipped.

(24) J. L. W., Chicago, Ill., asks:

How many air-brake cars should be operated by one engine? A.—All the air-braked cars in the train. With the air-brake apparatus in reasonably good condition, the engine can work as many air-braked cars as she can pull. Fifty, and frequently as many as eighty cars may be seen nowadays coupled up and air brakes all working.

(25) E. S., Kansas City, Mo., writes:

The auxiliary pressure equalizes with the brake cylinder when we have reduced the train line 20 pounds. We then have 50 pounds to the square inch on our piston. What I wish to know is, is that 50 pounds actual pounds or 35 actual pounds, and is the other 15 pounds made up by the brake levers? A.—The 50 pounds pressure on the piston is 50 pounds air pressure.

(26) J. L. W., Chicago, Ill., asks:

Which are more liable to slide, freight or passenger car wheels? A.—Passenger car wheels, because the braking power is higher, stops from higher speeds are made, and closer adjusted brakes are had on passenger cars. Again, passenger cars are stopped at places where the rail conditions are worse, and where sliding of wheels is more forcibly invited. There are other reasons, but these are the principal ones.

(27) C. L. M., Pittsburgh, Pa., writes:

I place my brake valve on lap and I get a service application on my train. If I try to make a service stop in service position I get the emergency. Why is this? A.—Your train pipe undoubtedly leaks so badly somewhere that when your brake valve is lapped the train pipe leaks are about equal to the air drawn from the pipe in a service application. When you draw off air in the service position this amount, added to that of the leaks, are together sufficiently heavy to cause an emergency application.

(28) J. B. M., Omaha, Neb., asks:

Can or how can he told how many air brake cars are coupled up by a five or six pound reduction? A.—A person must get accustomed to the train pipe discharge at the brake valve in service application. This discharge, of course, is longer with long trains. Close observation will enable a man to tell by the different lengths at discharge the different number of air cars he has coupled up. Some men become so expert in gaging the sound of the discharge that they can tell very closely how many air-brake cars are coupled up.

(29) R. & H., Mattoon, Ill., writes:

Towing a dead engine in a train, not equipped with cut-out cock under brake valve (E-6), is there any way to use this train line without putting a blind gasket between valve and train pipe? A.—A washer may be placed between the rotary valve key and cap, and the train pipe discharge be plugged. This is only an answer to the above question, and would be poor practice. The cut-out cock is furnished with each brake valve and should be placed in the train pipe under the valve where it belongs.

(30) A. D. W., Kansas City, Mo., writes:

I am running a yard engine equipped with the automatic air brake on driver and tender, D-5 engineer's brake valve, and old style triple. It does not make any difference what kind of an application I make, for just as soon as I place valve on lap, the driver brake flies right off, unless I make application of 40 pounds reduction. Then the brake hangs on. My brake did not work this way when new. Engineer's valve does not leak. A.—The indications point to a leaky rotary valve; that is, main reservoir air is leaking into the train pipe and releasing your brake. The rotary should be reseated, not merely ground in, but faced down to a tight joint by machine or hand tool, and then rubbed in with a little oil. Have this work done and your trouble will doubtless disappear.

(31) L. W., Xenia, Ohio, asks:

How can the D-8 brake valve be operated so as to carry an excess pressure? A.—First ascertain that the excess pressure valve spring is adjusted for 20 pounds and that the parts are free from gum and are clean. Next, place handle in running position, start pump and note that the main reservoir hand travels up 20 pounds ahead of the train line hand. After brakes are applied and you wish to release, place valve handle in release position for a second or two only, and then bring back to running position, thus saving your excess. After following the above directions, and the hands refuse to be separated from each other by 20 pounds, the spring is too weak, excess valve leaks, or rotary valve leaks, or a worn-out gasket allows main reservoir and train pipe pressures to mingle. These may be located and corrected by the usual methods.

The Seventh Annual Convention of the Air-Brake Association.

The Committee of Arrangements for the seventh annual convention have selected the St. James Hotel for the headquarters of the convention. A special rate of $2.50 per day has been secured for members.

As the weather at this season will be quite warm, the members are requested to prepare accordingly.

The Pullman Company have agreed to furnish free sleeping-car transportation to members returning from convention upon presentation of receipt showing amount paid in going and between what points.

On February 1 Mr. Otto Best was appointed superintendent of air brakes for the Nashville terminals. This position is a newly created one, and will be filled by Mr. Best in addition to his other duties as superintendent of air brakes for the Nashville, Chattanooga & St. Louis Railway, where, with the backing of progressive and up-to-date officials, he has brought the condition of air brakes to a high standard and second to no other road in the country.

Mr. T. A. Hedendahl, one of the foremost air-brake men in the country, and who has for about fifteen years been general air-brake instructor and inspector of the Union Pacific, has resigned that position to accept one with the Westinghouse Air Brake Company. Mr. Hedendahl's headquarters will be at Denver, Colo. His duties will be to look after his company's business and interests in that district. The Union Pacific loses a long-tried and faithful servant, and the Westinghouse Air Brake Company gets a good man.

It is not an uncommon thing, during extreme cold weather, to see an air-brake hose sticking out stiff from the end of a car, like a branch on a tree. It is a noticeable fact, too, that the hose which freeze stiffer are the older ones; and a closer examination will disclose checks and cracks in the outer rubber coating which allows the duck body of the hose to absorb moisture which, when frozen, renders the hose almost as stiff as an iron pipe.

The new locomotives of the Chicago & Alton are right up to date in their air-brake equipment. They have the high-speed brake attachment, main reservoirs of 50,000 cubic inches capacity, and brakes on all driver and truck wheels.

The reluctance of some railroads to use the air brake in its early days is shown by the following item, which appeared in one of the Michigan newspapers under date of May 31, 1873, and reads: "The Legislature, at its last protracted meeting, passed an act requiring all railway companies operating roads in this State to attach the air brake to each and every one of their passenger trains. How many companies will comply with this requirement remains to be seen."

Mr. C. W. Sherburne, of Boston, Mass., who already holds valuable patents for sanding the rail during brake application, has been granted further patents recently. In the system invented by Mr. Sherburne the sand may be caused to flow sparingly during either service or emergency application, or both, with the same turn of the brake valve handle that applies brakes. Sand, as is well known, if judiciously applied during brake application, increases very materially the holding power of the brakes.

Smokeless Firing.

"Well, you fellows just make me tired," exclaimed the old-timer, as he plastered the roundhouse window with a superannuated quid while trying to hit a fly.

"What makes you tired?" asked Thorn, of the "Owl."

"Why, that air ingineer paper in Noo York, and these here travelin' ingineers and dude firemen, allus talkin' about firin' without smoke."

"What do you know about it, anyway?" asked Radebaugh, of the Valley road.

"Young feller, I know a hull lot about it," replied the back number, "and I am right here to tell you kids that when I was throwin' black diamonts fer Barney Butz, on the Lehigh Valley, way back in the fourties, Barney could hit that old Millholland Pawnee all day, and she didn't show smoke as a seegareet. Why, damit, man, the idee is old as lots of young wimen."

"What kind of coal did you have?" asked Ferguson's fireman.

"Why, antersite, of course, genuine Beever Medder. Did you think we was burnin' natral gas? Yes, don't keer if I do; allus take somethin' about this time-oday."

Personal Department.

Mr. I. B. Thomas has been appointed master mechanic of the Pennsylvania at Renovo, Pa.

Mr. M. T. Fisher has been appointed master mechanic on the Great Northern at Kalispell, Mont.

Mr. V. B. Lang has been appointed master mechanic of the Eastern division of the Chicago & Alton at Bloomington.

Mr. J. M. Davis has been appointed superintendent of the Erie & Wyoming Valley, with headquarters at Dunmore, Pa.

Mr. John C. Mengel has been appointed master mechanic of the Pennsylvania at Erie, Pa., vice Mr. C. H. Potts, transferred.

Mr. C. H. Potts, master mechanic of the Pennsylvania at Erie, has been transferred to Sunbury, Pa., succeeding Mr. Reading, transferred.

Mr. A. E. Sweet has been appointed to succeed Mr. J. W. Robbins as trainmaster of the Atchison, Topeka & Santa Fé at Marceline, Mo.

Mr. C. F. Seymour, of the Minneapolis, St. Paul & Sault Ste. Marie, has been appointed trainmaster of the Baltimore & Ohio at Garrett, Ind.

Mr. J. W. Riley has been appointed trainmaster of the Pittsburgh & Lake Erie at McKee's Rocks, Pa., succeeding Mr. H. B. Pierce, transferred.

Mr. J. T. Robinson, master mechanic of the Southern at Selma, Ala., has been transferred to Spencer, N. C., vice Mr. W. H. Hudson, resigned.

Mr. H. J. Sloat has been appointed general foreman of the Lake Shore & Michigan Southern shops at Norwalk, O., vice Mr. W. H. Holland, transferred.

Mr. M. A. Berger has been appointed superintendent of the Central Pennsylvania & Western at Watsontown, Pa., succeeding Mr. C. D. Berger, resigned.

Mr. Leroy M. Carlton has been appointed general air-brake instructor of the Chicago & Northwestern, vice Mr. E. W. Pratt, promoted; headquarters at Chicago, Ill.

Mr. Walter G. Brownlee has resigned as division superintendent of the Missouri Pacific at St. Louis, Mo., to accept a similar position on the Grand Trunk at Montreal, Que.

Mr. J. C. Hyde has been appointed acting superintendent of the Pittsburgh division of the Buffalo, Rochester & Pittsburgh, vice Mr. J. M. Floesch; office at Butler, Pa.

Mr. C. S. Larison, formerly a passenger engineer on the Pacific division of the Northern Pacific Railway, has been appointed road foreman of engines for the district from Mandan to Billings, Montana.

Mr. A. R. Whaley has been appointed superintendent of the Worcester division of the New York, New Haven & Hartford at Providence, R. I., succeeding C. C. Burnett, deceased.

Mr. W. G. Wallace, road foreman of engines of the Madison division of the Chicago & Northwestern, has been promoted to the position of general foreman of the shops at Clinton, Ia.

Mr. F. E. Davisson, who has been acting master mechanic of the Santa Fé, Prescott & Phoenix and Prescott & Eastern, has been appointed master mechanic; office at Prescott, A. T.

Mr. W. B. Denham, division superintendent of the Plant System at Gainesville, Fla., has been appointed general superintendent at Savannah, Ga., vice Mr. Bradford Dunham, resigned.

Mr. J. J. Thomas, Jr., master mechanic of the Mobile & Ohio at Tusculoosa, Ala., has been appointed assistant superintendent of motive power and car equipment, with office at Mobile, Ala.

Mr. J. W. Robbins, trainmaster of the Atchison, Topeka & Santa Fé at Marceline, O., has been transferred to the Eastern division at Topeka, Kan., succeeding Mr. H. A. Tice, promoted.

Mr. R. J. Parker, superintendent of the Middle division of the Atchison Topeka & Santa Fé at Newton, Kan., has been transferred to the Western division at Pueblo, Colo., vice Mr. Chas. Dyer, resigned.

Mr. I. N. Kalbaugh, assistant superintendent of machinery of the Baltimore & Ohio at Newark, O., has been appointed master mechanic at Glenwood, Pa., succeeding Mr. Joseph Billingham, transferred.

Mr. Jacob C. Miller, general foreman of the locomotive department of the Chicago, Milwaukee & St. Paul, has been promoted to the position of master mechanic at Milwaukee, Wis., succeeding Mr. F. W. Deibert, resigned.

Mr. Eugene Chamberlin, formerly master car builder of the Western division of the New York Central & Hudson River, has been appointed superintende t of equipment of the Brooklyn Rapid Transit, Brooklyn, N. Y.

Mr. H. A. Ford, trainmaster of the Kansas City, Memphis & Birmingham at Amory, Miss., has resigned to accept the position of division superintendent of the Plant System at Gainesville, Fla., vice Mr. W. B. Denham, promoted.

Mr. A. W. Trenholm, superintendent of the Nebraska division of the Chicago, St. Paul, Minneapolis & Omaha at Omaha, Neb., has been promoted to the position of general superintendent at St. Paul, Minn., vice Mr. J. C. Stuart, resigned.

Mr. S. G. Strickland has been appointed superintendent of the Nebraska division of the Chicago, St. Paul, Minneapolis & Omaha at Omaha, Neb., succeeding Mr. A. W. Trenholm, promoted. Mr. Strickland was heretofore trainmaster.

Mr. Chas. H. Osborne, assistant foreman to Mr. E. W. Pratt, on the Chicago & Northwestern at Chicago, has been promoted to the position of roundhouse foreman at Green Bay, Wis. Mr. Osborne is a graduate of the Sheffield School of Yale.

The following engineers have been appointed assistants to Mr. J. K. Russell, road foreman of engines, Pittsburgh division of the Pennsylvania; W. S. Dobson, Pitcairn, Pa.; W. L. Hudson, Derry Station, Pa., and Willis Black, Altoona, Pa.

Mr. John T. Wheeler, formerly in the purchasing department of the Grand Rapids & Indiana Railway Company at Grand Rapids, Mich., has been appointed purchasing agent of the Sargent Company, of Chicago, with office at 675 Old Colony Building.

Mr. E. H. Cutter, trainmaster of the Wisconsin Central at St. Paul, Minn., has been appointed assistant superintendent of the Ashland division of that road at Ashland, Wis., and Mr. W. F. Anderson, who has been trainmaster at Ashland, goes to St. Paul.

Mr. R. K. Reading, master mechanic of the Philadelphia & Erie division of the Pennsylvania at Sunbury, Pa., has been appointed master mechanic of the Northern Central, a branch of the Pennsylvania, with office at Baltimore, Md., vice Mr. J. M. Coale, retired.

Mr. Charles Blackwell has been appointed chief engineer of the Wheeling & Lake Erie Railroad Company, to succeed Mr. F. E. Bissell, who has resigned to accept service with another company. Mr. Blackwell is a very well known master mechanic and has an excellent training, which will no doubt make him very successful in the position he has taken.

Mr. George W. Stevens has been made president of the Chesapeake & Ohio Railway, of which he has been vice-president and general manager for nine years. Only about a month ago Mr. Stevens, who is a remarkably modest man, disclaimed to the writer any thought of succeeding Mr. Ingalls as president. We are glad that he was mistaken, and we know that the people high and low belonging to the Chesapeake & Ohio will rejoice with us.

A few months ago Mr. A. T. Clarke, who has been general superintendent of the Minneapolis & St. Louis for fourteen or fifteen years, accepted the position of general manager of the Central of Iowa. Mr. Clarke was one of the most popular officials in the Northwest, and we have received several letters from employés of the Minneapolis & St. Louis in which regrets were expressed because Mr. Clarke had gone away. From the limited intercourse we have had with Mr. Clarke we were much impressed with his genial, agreeable manner.

Mr. Wm. Owens, who has been an engineer on the Black Diamond Express, on the Lehigh Valley Railroad, for the past three years, has resigned that position and gone into the service of the New York Air-Brake Company, with headquarters at Buffalo. Mr. Owens began running a locomotive in 1881. He came to the Lehigh Valley in 1890 from the Illinois Central as a locomotive engineer, and was later on promoted traveling engineer, which position he filled for about three years. He is one of the charter members of the Traveling Engineers' Association who has been a worker right along.

The following changes have been made on the Missouri Pacific: Mr. M. Stillwell appointed division superintendent of St. Louis and Sedalia sections of Eastern division, with headquarters at St. Louis, Mo., succeeding Mr. W. G. Brownlee, resigned; Mr. I. H. Luke appointed division superintendent of Kansas City section of Eastern division, with headquarters at Sedalia, Mo., succeeding Mr. M. Stillwell, transferred; Mr. A. De Bernardi appointed division superintendent of Central branch Union Pacific Railroad and Rooks County Railroad, with headquarters at Concordia, Kan., succeeding Mr. I. H. Luke, transferred.

Mr. W. K. Christie, who was lately appointed master mechanic at Saginaw, on the Pere Marquette Railroad, got some of his early education in railroad shop methods at Fort Wayne, Ind. In July, 1875, he went to the Detroit, Lansing & Northern Railroad, and later on was made general foreman of engine house and machine shop under Mr. George O. Keefe, master mechanic. In 1892 he was appointed master mechanic on the Chicago & West Michigan Railway, and the machinery there soon showed his ability and care, both in its appearance and the work done in proportion to shop expense, as his practice was to do the work well in the shop and then see that the engines were taken care of afterward as well.

Mr. Dudley Mitchell has resigned his position as chief clerk to the superintendent of motive power and machinery of the Chicago, St. Paul, Minneapolis & Omaha Railway, and has accepted a position with the Hocking Valley, with headquarters at Columbus, Ohio. He will have full charge of the car distribution of the coal lines of that company. Mr. Mitchell commenced on the Chicago, St. Paul, Minneapolis & Omaha road in 1886 as telegraph operator, and has since served in the capacity of city ticket agent at Duluth and chief clerk to superintendent of motive power and machinery. Mr. Mitchell has always been very popular with the management and employés of that system, and their best wishes go with him.

Mr. Robert Miller, superintendent of motive power of the Michigan Central, has resigned. Mr. Miller is one of the best known officials in railroad service, and has a host of friends who will be sorry to learn of his retirement. He is a veteran of the civil war. Before the war he served an apprenticeship in the car shops of the Chicago, Burlington & Quincy. On returning from the army he obtained a position as shop foreman on the Chicago, Burlington & Quincy, and in 1876 left there to be master car builder of the Michigan Central. Then he was made assistant general superintendent, and a few years later general superintendent. On the death of Mr. C. E. Smart, in 1896, he was made superintendent of motive power and equipment, which position he filled till the end of January.

Mr. E. D. Bronner, who has been for several years assistant superintendent of motive power of the Michigan Central Railroad, has been advanced to the head of the mechanical department. Mr. Bronner has obtained all his engineering experience on the Michigan Central, having begun in 1883 as a draftsman on the Canada Southern, at St. Thomas. When that road was absorbed by the Michigan, he was moved to Detroit as draftsman, then he was made shop foreman in the car department, and later master car builder. He held the latter position for several years, and four years ago was made assistant superintendent of motive power and equipment. Mr. Bronner is highly popular among the men in the mechanical department, and will no doubt prove successful in his new position.

Mr. E. W. Pratt, whose writings are so well known to the readers of Locomotive Engineering, has been advanced from general air-brake inspector of the Chicago & Northwestern Railway to be general foreman of the Galena division roundhouse, Chicago. There ought to be something good in store for Mr. Pratt in railroad service, for although a young man, he has gone through a varied experience that ought to make him valuable. He was a civil engineer on the Chicago & Northwestern before going to the Lehigh University, where he graduated as M. E. in 1890. Then he went to be designing engineer for the Western Electric Company, and subsequently was superintendent of the Chicago Hardware Manufacturing Company, a position he left to return to railroad life.

The following changes have been made on the Chicago, Milwaukee & St. Paul: Mr. H. R. Williams has been appointed general manager, vice Mr. W. G. Collins, resigned; Mr. W. J. Underwood has been appointed general superintendent; Mr. C. A. Cosgrave has been appointed assistant general superintendent of the Northern district; Superintendent W. W. Collins has been transferred to the Iowa & Dakota division; Superintendent J. F. Gibson has been transferred to the Chicago & Milwaukee, Chicago & Council Bluffs division in Illinois, Racine & Southwestern and Chicago & Evanston divisions; Superintendent H. B. Earling is transferred to the Chicago & Council Bluffs (in Iowa) division; Superintendent P. C. Eldredge has been transferred to the Prairie du Chien and Mineral Point divisions; G. H. Atkins has been appointed superintendent of the Wisconsin Valley division; E. G. Perkins has been appointed trainmaster of the River, Chippewa Valley and Wabasha divisions; Mr. W. B. Foster has been appointed trainmaster of the Southern Minnesota division, vice Mr. E. G. Perkins, transferred.

The following changes have been made on the Union Pacific: Mr. P. H. Stack has been appointed general air-brake inspector, reporting to the superintendent of motive power and machinery. His duties also take in steam heat, Pintsch gas, etc. Mr. Stack has been traveling engineer for the Union Pacific system for the past eight years, reporting to the superintendent of motive power and machinery. Mr. D. H. Breese has been appointed traveling engineer, with jurisdiction from Rawlins, Wyo., to Cheyenne Wells and Julesburg, Colo., reporting to Division Master Mechanic J. H. Manning. Mr. Breese has been running a passenger engine out of Laramie for over twenty years. Mr. Melville Birney has been appointed traveling engineer (jurisdiction from Rawlins, Wyo., to Ogden, Utah), reporting to Division Master Mechanic J. H. Manning. Mr. Birney has been running a freight engine out of Rawlins for the past twelve years. Mr. Harry Langdon has been appointed traveling engineer for Nebraska division (headquarters at North Platte), reporting to Division Master Mechanic Barnum at Omaha. Mr. Langdon has been running an engine for the Union Pacific for the past fifteen years.

The following changes were announced by Mr. W. H. Lewis, superintendent of motive power, as having been made among the mechanical officials of the Norfolk & Western, beginning on February 1, 1900: Mr. J. E. Battye has been appointed division master mechanic of the Eastern General division, vice Mr. R. P. C. Sanderson, resigned to accept service with another company; Mr. H. F. Greenwood has been appointed general foreman of the locomotive department at Roanoke shop, vice Mr. J. E. Battye, transferred; Mr. C. N. Sanders has been appointed chemist, vice Mr. W. W. Davis, resigned to accept service with another company; Mr. H. F.

Staley has been appointed general foreman at Kenova, vice Mr. F. P. Hickey, resigned to accept service with another company; Mr. J. H. Snider has been appointed foreman at Shenandoah, vice Mr. H. F. Staley, transferred; Mr. L. D. Gillett has been appointed general foreman at West Roanoke, vice Mr. S. K. Dickerson, resigned to accept service with another company; Mr. G. I. Fairbrother has been appointed road foreman of engines on the Radford division, vice Mr. L. D. Gillett, transferred; Mr. L. B. Murray has been appointed road foreman of engines on the Scioto Valley division, vice Mr. J. J. O'Rourke, transferred.

By a printed announcement we have learned that Mr. A. G. Leonard, who has been for several years assistant to the president of the Union Stock Yard & Transit Company, of Chicago, has been appointed general manager. Mr. Leonard is a good example of what self-help and diligence in "doing with all your might that which your hands find to do" are daily accomplishing in selecting men for the higher positions in railway service. It seems only to have been a few years ago that we found Arthur a boy in the office of Mr. Buchanan, superintendent of motive power of the New York Central. But the boy was inspired by the sentiment that whatever he had to do must be done well, and he soon made himself so useful and reliable that he was made Mr. Buchanan's principal assistant. When Mr. Webb was made vice-president and general manager, he looked about for an efficient assistant, and his choice fell upon Mr. Leonard, who performed the duties with great tact and ability. During Mr. Webb's long illness Mr. Leonard carried on the duties of the office and was in reality general manager. He has naturally a great power in grasping details and tabulating them so that they will be understood readily. While in Mr. Webb's office he kept most comprehensive records which indicated daily the receipts and expenditures that proved very useful in regulating the business. Mr. Leonard is an industrious student of problems relating to his work, and by that means has acquired the knowledge that made his services so valuable.

Mr. G. J. Netter, of East Pittsburgh, Pa., has been granted a patent for an automatic coupling for air-brake hose.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(21) W. W. R., Cripple Creek, Colo., asks:

Will you please inform me of some means of detecting a cracked follower plate or head without removing the cylinder head? A.—There can be no means of doing that.

(22) R. W., Buffalo, N. Y., writes:

What would you do if your injector failed to work, and you knew it was in good order? A.—Examine the tank to see if there was water in it. A supply being found, then would examine the strainer. If water can flow freely to the injector and it is in good order, it must work, unless there is some obstruction between it and the check valve.

(23) J. A. H., Pine Bluff, Ark., asks:

1. Is there boiler pressure in lubricator, both condenser and oil chamber? A.—1. Yes. 2. While working full throttle are the tallow pipes from steam chest to lubricator full of condensed water, or is it steam? A.—2. It is generally a mixture of both, but with the most improved lubricators means are provided for preventing water from forming in the pipes.

(24) G. J. D., Rat Portage, Ont., asks:

Is it possible for the low pressure piston on a Vauclain compound to get broken and not give signs enough for a man to detect it? A.—It has happened several times that the low pressure piston head of a Vauclain compound has broken off without the engineer detecting it. There are two ways of detecting that accident. The engine becomes deficient in power and the exhaust sound would lead one to believe that the valves were badly set.

(25) M. G., City of Mexico, asks:

Is it possible to run a 235,000-pound locomotive on a rail of 33.4 pounds per meter? A.—This is about 30 pounds to the yard, and according to the usual practice the heaviest engine this should carry is about 56,000 pounds. This allows 48,000 pounds on eight drivers and 8,000 pounds on a pony or half truck, as in a consolidation. The weight a rail can support depends on its weight and section, and there is a lack of satisfactory information on this subject.

(26) Apprentice, Cleveland, Ohio, asks:

How can I calculate the horse-power of a locomotive? A.—We have often answered this question, but it always comes up periodically. The rule is multiply the area of the two pistons by the mean effective steam pressure in pounds; multiply that by the piston travel in feet for each revolution; multiply by the revolutions per minute and divide by 33,000. You will find the problem worked out in the 1899 edition of "Sinclair's Locomotive Engine Running," page 313.

(27) G. J. C., Collinwood, Ohio, asks:

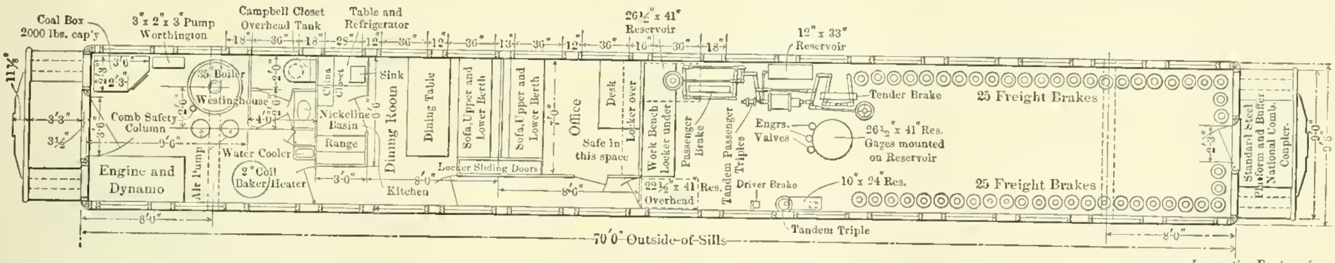
If I break the side rod on a tandem connected engine and have to take down both side rods, would it be safe to take engine and train to its terminal? A.—If you mean by "tandem" connected engine one that has the eccentrics on driving wheels that the main rod is not connected with, we would say that the chances of getting to a terminus after taking off the side rods would be rather slender. There is always more or less slip of the driving wheels, and that would throw the relation of the valve and the piston out of synchronism.

(28) L. W., Xenia, Ohio, asks:

In what position are the eccentric rods in relation to the link block in the backward or forward motion? A.—It is not quite clear what kind of an answer is desired. In American engines with a rocker (indirect motion) the forward eccentric rod takes hold of the top of the link, and the backing eccentric rod at the bottom. In the extreme forward motion the link block is controlled almost entirely by the upper eccentric rod, and the opposite is true in the extreme backing motion. As the link is hooked up, the action of each eccentric is modified to some extent by the other. If this is not what you meant, let us know and we will try to help you.

(29) G. H. S., St. Louis Mo., asks:

The engine that I am running has balance slide valve; one of the plates on the side of one of the valves blows through; engine also has single nozzle. How can I tell on which side of the engine the valve is blowing? A.—There are several methods of finding out when a balancing



PLAN OF INTERNATIONAL CORRESPONDENCE SCHOOL AIR-BRAKE CAR.

(*Description on page 122.*)

strip of a slide valve is broken. If the valve is put on the middle of the seat, so that the oil hole will be immediately over the exhaust port, and a little steam applied, you will hear the blow distinctly. Others get on the running board and hold a foot lightly on the valve rod when the engine is working hard and moving slowly. The extra friction makes the stem vibrate in a way that one can easily identify which side the trouble is on.

(30) J. L. L., Jacksonville, Fla., writes:

1. Will you tell me how to remove the truck from a mogul or consolidation, on the road? A.—1. The radius bar must, of course, be disconnected. Block up the front end high enough to take the center pin out of the bearing. The truck can be removed. The blocking of equalizer depends on the construction. It is sometimes unnecessary, as the equalizer or cross-beam may bear against boiler before the front end goes down enough to do any harm. When necessary, the equalizer, cross-beam or front driver springs must be blocked to keep engine going down too much at the head. 2. In swinging the back drivers, how would you place weight on tender truck without throwing it on the springs? A.—2. We wouldn't put it on tender at all, but would block between boxes and frame of the forward wheels, transferring the load from the back drivers to these. The same thing applies to a ten-wheeler as to a mogul, excepting the truck. Except on small roads, the first thing to do is to get off the main line, so as to prevent delay of traffic. The old idea of disgrace in being towed in, isn't considered now. It's a question of keeping the road open and cost of repairs.

(31) W. T. G., Svenson, Ore., asks:

1. Who built the heaviest locomotive up to date? A.—1. Brooks, for the Illinois Central. 2. How heavy is the heaviest track now in use, and are the rails usually referred to as so many pounds to the foot or to the yard? A.—2. One hundred pounds to the yard. So many pounds to the yard. 3. What danger must be looked out for in letting a heavy train down a grade when the brakes on the engine give out and the reverse lever and the steam must be used to nearly the full capacity or strength of the engine? A.—3. Knocking out of the cylinder heads. 4. Is there any danger of a boiler blowing up or getting damaged in case of priming? Will the water lift from the crown sheet so as to let it get hot and cause a rupture when settling again? A.—4. There is danger of the water getting too low, and in that case the sheets would be damaged. 5. Which is the most saving on steam and fuel—to hook the reverse lever up and shorten the valve travel, or hook the reverse lever so the valve gives steam full stroke and close the throttle to pull the same load at the same speed? A.—5. We cannot understand how anybody connected with locomotive or steam engine operating should ask this question. If it was more economical to work an engine full stroke there would have been no provision made for reducing the valve travel. 6. If a locomotive is stopped for some time and has a heavy fire, is there any danger of an explosion by starting with a heavy train? A.—6. No; not if there has been plenty of water kept in the boiler.

Minneapolis & St. Louis Notes.

The Minneapolis & St. Louis Railroad have made large additions to their motive power, twenty-one new engines having been delivered inside of the twelve months ending February, 1900. They now have seventy-six in all. Some of them are six-wheel switch engines, with 20 x 24-inch cylinders, 42-inch wheel centers, carrying 200 pounds of steam. They have only one compound.

Their new extension gives them a direct line from St. Paul to Omaha, on which a fast service will be maintained. Part of the way is over the new piece of track lately finished by the Illinois Central Railroad.

They are now getting ready for some extensive additions to the shops. The addition to the boiler house is now finished, and an additional battery of boilers is being installed. The new pumping plant takes water from two 8-inch driven wells, and has just gone into service. Water mains are laid between each of the buildings, and a line runs clear around the entire plant, with plenty of hydrants. A steady pressure of 100 pounds is maintained, and this pressure is used for washing out. Ejectors attached to the hydrants in the roundhouse warm the water for washing out, and furnish it very hot for filling up boilers. A new Ingersoll-Sergeant compressor is just going in; it has a capacity of 650 cubic feet of free air per minute. Compressed air is used everywhere about the shops and engine house.

The machine shop, blacksmith shop, boiler shop and coach shop all are to have extensive additions of a permanent character in the spring. A new storeroom is to be built, of a generous size, to do all the business without any crowding. Ten new machines were put in the machine shop last year, and five in the wood-working shop.

New hydraulic jacks are being put in the drop pits. There are three located in different parts of the roundhouse; two will take out driving wheels and one for truck wheels. We saw one or two sets of hydraulic jacks for the other engine houses on the line ready for shipment. The big Leslie rotary snow plow was idle in the engine house, waiting the arrival of snow-drifts to start its winter campaign.

The outfit of excavators, gravel plows, steam unloaders and ditching machines used on this line in construction work is a sight.

Mr. Tonge is making his ashpans out of

a single sheet of steel, bending it to the proper shape, with stiffeners at the corners, held by four rivets.

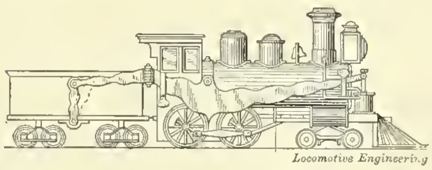
To prevent the steel driving boxes catching on and cutting the cast-iron wedges and shoes he cuts eight or ten oil grooves obliquely across the surface of the steel box where it bears against the wedge, which gives good results.

Mr. Tonge takes a live interest in the education of his men, and gives them great credit for their skill and progress.

Traction Increasers.

The patent shown in the accompanying cut is probably one of the "foolest" sche·es for increasing traction ever put on paper, and illustrates very forcibly the patent craze that some men seem to enjoy.

As will be seen, the plan is to have a steam cylinder on the front end, and not very delicate levers on each side. Why these levers have just the artistic shape shown is not clear—possibly he was like the machinist who had heard of the "paregoric" curve and wanted one. These levers are hinged between engine and tender, and have a compensating link to take care of curves. They are s pported by a sort of



THE LATEST ADHESION INCREASER.

saddle over the boiler, just ahead of cab, which also ought to act as a boiler explosion preventer, for it would be a cheeky boiler that would blow up when it was being held down by the fond embrace of this arrangement. When the engine begins to slip, you don't give her sand—that's old now, in spite of the sanders; you just turn steam into the front cylinder and the tender humps itself, throws its weight on the drivers, and away you go. This also relieves weight from tender bearings and prevents heating. The question of hot driver journals is another matter, for which other patents are probably forthcoming.

The engineer and fireman have a choice of three ways of getting on the engine—crawling upon the cab roof and dropping down, climbing over the tank from the first car, or if they are small enough and athletes, getting in under the coupling device between engine and tender. How they would get out in a hurry if they should see a tail-end just ahead isn't quite clear. They'd probably be heroes and "stick to 'her' to the last," etc.

The traction-increasing idea is older than most men think, dating back to 1836 at least. In that year we find the engine "George Washington," built by Norris, in Philadelphia, equipped with a draft link which threw nearly all the weight of the tender on the drivers when desired.

Ross Winans patented in 1851 the use of steam cylinders over the driving boxes for this purpose, as was shown in our issue of October, 1898, on page 456. It was not used to any extent, however.

Mr. G. S. Griggs, of the old Boston & Providence road, used a device for this purpose on his engine, "Hilander," which was at the famous Lowell tests in 1851, and it received a medal. This arrangement was a combination of levers or a toggle, which increased the portion of the tender weight thrown on drivers as the draw-bar pull grew heavier. It was a very ingenious device, and did the work, but was never used to any extent.

Mr. Wilson Eddy also used a portion of his tender weight for adhesion by making the draw-bar higher on the foot-plate of engine than on tender. They frequently had to jack tender up a little to couple.

All probably remember the electric scheme of Elias Reis, of Baltimore; but none seem to be long lived. The single-driver engine which went to England to exploit the Eames brake also had a steam traction increaser. The best of the lot appears to be that of Mr. Griggs, but at the present time there is little need for such a device. The engines of to-day carry about all the weight on their bearings that can be done with safety, and with the sanders we now have there is little field for a device of this kind, even if a good one. But the one shown is the most unmechanical arrangement it has ever been our misfortune to see.

Our Railroad and Our Canals.

A very interesting address was delivered at the annual banquet of the Utica Chamber of Commerce by Mr. George H. Daniels, of the New York Central, on "Our Railroads and Our Canals." The address was largely historical, and showed how canals had decayed while railroads increased in usefulness. The following were the closing paragraphs of the address:

"The tonnage of all the property carried on all the canals in both directions in 1837," Mr. Daniels said, "was 1,171,296 tons. The tonnage increased until 1872, when it amounted to 6,673,370 tons. From 1872 the tonnage carried decreased, until in 1897 there were only 3,617,804 tons carried—this in face of the fact that the receipts of grain and flour at Buffalo had increased from 1,184,685 bushels in 1837 to 242,140,306 bushels in 1897.

"There are three general causes for these results. The first is the great reduction in the rates of freight by the railroads in the United States, and notably in the State of New York. The second cause is the marvellous development of the motive power and rolling stock of American railways. Less than a quarter of a century ago, upon the average American railroad, the capacity of a freight car was 20,000 pounds; the capacity of a freight engine was from twenty to thirty of such cars to the train.

"To-day, on the New York Central, whose six tracks run alongside the Erie Canal for the entire distance from Buffalo to Albany, a grain car, loaded to its full capacity, will carry 1,000 bushels of grain; one of the later type of locomotives will haul seventy-five such cars, aggregating 75,000 bushels as an ordinary train load, equivalent to the production from 3,750 acres of wheat land on basis of 20 bushels to the acre, or an area of about six square miles. The same engine will haul from 110 to 125 empty cars. It is not an infrequent occurrence for a single engine to haul through the Mohawk Valley, beside the Erie Canal, 85,000 to 90,000 bushels of grain in a single train. When you consider that in the busy season there may be from seventy-five to one hundred such trains a day passing over the New York Central alone, you will get some conception of the situation."

Florida East Coast Shops.

One of the neatest and best managed small shops that I have found in the South is that of the Florida East Coast Railroad, at St. Augustine, Fla., which is under the charge of Mr. G. A. Miller, master mechanic of the road. The shop does not have many tools to do the work on thirty-five engines and 550 cars, but those in use are worked up to their full capacity, and numerous labor-saving appliances help out in doing the work. The power is very deficient for the work it has to do, and the sandy road cuts the tires very rapidly, so that tire-turning calls for more than ordinary attention. They run only about 20,000 miles between turning. As the engines would frequently have to be shopped merely for tire-turning, Mr. Miller has arranged so that engines have not to be taken in for that work. The tires of nearly all the engines are of uniform size, so he has tires turned ready to put on when an engine needs a set, and they are put on in a few hours. The turning is done on a pair of centers made by the Schenectady Locomotive Works, and they have turned out to be a great time-saving device.

Mr. Miller is very ably assisted by Mr. Burgman, who was for years general foreman of the West Shore shops at Frankfort, N. Y., with Mr. J. M. Boon. He seems always to be scheming out home-made appliances for getting out work promptly and cheaply. The engine parts are all interchangeable, and are kept in that condition. When an engine comes into the shop for an overhauling there are always a great many parts on hand ready to take the place of those needing repairs. This makes a material difference in the time an engine has to be kept out of service.

Besides a variety of other first-class tools, they have in this shop the latest form of Betts wheel-boring machine, which has a tool for facing the hub of the wheel. The men in charge are quite enthusiastic about the efficiency of this tool. They have in use a differential chain hoist driven by a small high-speed engine made by the Empire Engine Company. The combination makes a remarkably efficient way of raising heavy weights.

Besides repairing the rolling stock and all the machinery connected with the road, they have to keep the machinery of several steamers in order, which sometimes puts considerable strain upon the resources of the place. A short time ago one of the boats bent a heavy shaft about 12 inches diameter. There was no tool that would carry such a heavy piece, so they rigged up on a piece of timber 20 x 20 inches. They forged heads for this improvised lathe, set them up and placed the shaft between the centers. A temporary forge was then set up at the point where the bend was, and the great mass of iron was heated so that it was straightened. The journals were then trued up, and the job was done just as well as if the shaft had been sent to Jacksonville, and at one-tenth the expense.

Work was rushing on the road when I was at St. Augustine, and Mr. Miller was embarrassed for want of engineers. That is a condition of affairs that happens frequently on Southern roads, where there is not a large force of firemen to draw from for promotion. It appears to be the prevailing practice to employ whites for about half the force of firemen, but it happens sometimes that the oldest men have not had experience enough to be promoted when extra engineers are needed.

The fireman problem is rather a troublesome one on Southern railroads. Colored men seem to be much more available than white men as firemen, and it seems that many of the engineers prefer colored firemen, which acts as a bar to a greater proportion of white men being employed. The colored man will act as a body servant for the engineer, and that influences a good many men in their choice. On some roads they follow a peculiar course in preparing men for engineers. They take on a large proportion of white helpers or apprentices into the repair shops, and these men are employed long enough for being advanced to the position of engineer. While working in the shops they know what their future privilege will be, and those who are of the right material to make engineers devote attention to learning the work of taking care of the engines. When the time comes they are sent firing, sometimes for only a few months, and then they are promoted. A master mechanic talking to me about this system said that it worked very well indeed. S.

The Hilles & Jones Company, of Wilmington, Del., have issued catalogue No. 6 of machine tools. It is finely illustrated and is bound in buckram, but is not standard size.

Lining Shoes and Wedges.

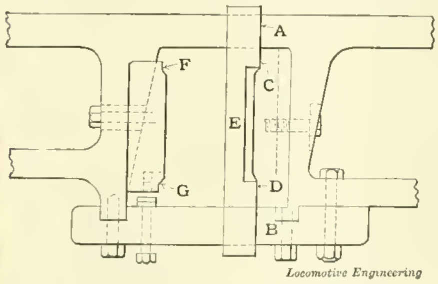
Mr. Chamberlin's communication on "Lining Shoes and Wedges," I found, carried me back fourteen years, to the old Union Pacific shop in Omaha, where it seemed as but yesterday we lined shoes and wedges by a method which I wish to describe as having, I think, some advantages over that of Mr. Chamberlin.

The difference in the two methods begins with the names, as we called it spotting shoes and wedges, and it ends, also, with a "spot" instead of a "witness mark" —and a spot is a pretty definite thing to end with, as many a man who has been "spotted" by a fatal spot has "perished on the spot" to testify.

Well, tragedy jokes aside, this was (still may be) the old Union Pacific way:

We will start with the half widths of the driving boxes found and the corresponding center lines marked on the frames —only we often used (on old engines especially) a regular "fish tail" tram from the truck center casting.

A and *B* are the forward points, made with reference to the half width of the box on the frame and binder respectively.



LINING SHOES AND WEDGES.

E is the gap straight-edge cleared out in the middle of its edge so as to admit of its use as shown by sketch, the top and bottom end edges tangent to the points *A* and *B*, when the inside corners are in contact with the "spots" *C* and *D*, which are chipped and scraped to admit of this, as shown.

A long straight-edge is then blocked up on the binders and applied to base of shoe at point *D* and the corresponding point on shoe at other side of engine, a strip having been chipped across the bottoms of the shoes to admit of this. These strips are so filed across the bottoms of the shoes as to show a third spot on the inside edge of shoe from the "marking" coating edge of straight-edge where straight-edge is rubbed back and forth by the man on either side of engine.

The three points so obtained on the shoes are used to fix corresponding spots *F* and *G* and the inside spot on wedges by means of inside calipers set to width of driving box.

All of these spots are lightly prick-punched, and if it takes any longer to get them under the engine—which I doubt —time is saved in the greater speed and accuracy with which the planer man sets them to his surface gage on the planer.

When shoes and wedges are all up again these are the actual working "spots"—just as decisive telltales as the spots of gore above referred to.

Jump the wheels, adjust the wedges rightly, and if the journals have been trued, there will be no trouble about wheels tramming. If the journals haven't been trued—but that's another story.

Plainfield, N. J. E. H. MUMFORD.

A Valuable Valentine.

The 14th of last month was St. Valentine's day, which was no doubt the occasion of many attractive souvenirs being received. Among the most celebrated valentines received that day was one which came to Mr. H. H. Vreeland, president of the Metropolitan Railway, New York. It was in the form of a check for $100,000, and was sent by the Whitney Syndicate, the principal stockholders of the Metropolitan Railway Company. Mr. Vreeland graduated towards fame and fortune on surface railroads, where he rose through the grades of conductor, superintendent, etc. Mr. Vreeland is president of the New York Railroad Club, and is as affable with the members as he was befo e his deserved good fortune overtook him. An official of the company, talking about the valentine, said: "There are other feast days, however, beside St. Valentine's Day, and Mr. Vreeland, like other people, has a birthday once a year. On these, in the past, he has received similar tokens of regard from members of the Metropolitan Street Railway Company."

An excursion from New York to the Pacific Coast has been arranged for the benefit of the locomotive engineers, belonging to the New York Central system, and their wives. Dr. Webb secured for them the use of five Pullman cars, and Mr. Van Etten, general superintendent of the New York Central, obtained complimentary transportation for the cars to the Pacific Coast and back. An organization has been formed to manage the excursion, of which Mr. William Pellings is president and Mr. W. J. Hurley secretary and manager.

There is a growing practice of putting sand pipes in front of the truck where a truck brake is used. This gives a little grit on the brake shoes and helps in making a quick stop. This was used on the Brooks engine for the Chicago & Alton, shown on page 45 of the January issue.

It does us good to read such items of news as that which says: Gideon Hawley, of Conneaut, Ohio, who entered the service of the Michigan Central in 1846 as a fireman, and is now the oldest engineer on the Lake Shore & Michigan Southern, is about to be retired on a pension of $97 a month.

Compressed Air Motors in Snow.

The snowstorms that spread over a large part of tne country during the month of February brought out very conspicuously the weak points of electric motors in the operating of street and elevated railroads. On the other hand, the experience proved highly favorable to the operation of compressed-air motors that are at work in a few cities. There are twenty Hoadley-Knight compressed-air motors and several of the Hardie type at work on Twenty-eighth and Twenty-ninth streets in New York, and they kept right at work in the deepest of the snow and pushed other motors out of the way when they were stalled in the drifts. Mr. H. H. Vreeland, president of the Metropolitan Street Railway Company, and also president of the American Air Power Company, has a very high opinion of the compressed-air motor, and is inclined to use it on all lines not already supplied with mechanical motive power.

An important improvement in the valve motion of compressed-air motors has recently been designed by Mr. Robert Hardie. It so controls the cut-off that the air can be expanded down to the atmospheric line. The latest motors in use do the work with about half the air that was required a few years ago.

Part of a report from Chicago reads:

"During the late blizzard which occurred here in Chicago, the Lake Street Elevated were compelled to abandon their service from 11 o'clock P. M. until daylight in consequence of the heavy fall of snow, and while the cable part of the line was kept reasonably clear of snow by the snow plow, we were compelled to keep the lower end of the line clear from the accumulating snowdrifts by 'bucking' the snow with the air cars and cleaning the tracks with the scrapers on the cars, and yet we made schedule time, and in one instance was compelled to push a horse-car, drawn by four horses, which had been stalled on a curve.

"During the night we were called upon to assist in moving a large cable snow plow, which had been stalled by losing its grip on the cable around the curve from the Lincoln Avenue line, by attaching a large rope to the car and to the snow plow, the car being backed until its power pulled the snow plow to its track at Clark street, wh re it could again pick up its own cable. This was not a direct pull, as our car was located on the other track. After performing this service, the car was again presed into service at the limits barn, to push out the cable cars, enabling them to make up the cable trains, we pushing the cars through drifting snow, and also performing the work which was difficult for two horses and six men. This service was all performed during exceptionally bad weather, and during the zero weather of the previous week the compressed-air motor service was absolutely reliable, winning for this service the confidence as well as the friendship of the street railway officials."

Rhode Island Locomotives for Colorado Southern.

The Colorado & Southern Raiway Company have placed orders with the Rhode Island Locomotive Works, Providence, R. I., for five consolidations and three ten-wheel passenger locomotives. General dimensions as follows:

Consolidations—Having cylinders 21 x 28 inches; driving wheels, 56 inches diameter; and will weigh 166,000 pounds, of which 148,000 pounds will be on the drivers. The boiler will be of the straight type, with radial stays, and a working steam pressure of 190 pounds. The tubes will be of charcoal iron, Tyler branch, 2 inches diameter. 13 feet 6 inches long; firebox, 114 inches long, 41¼ inches wide; double-riveted mud ring. Tank capacity for water will be 5,500 gallons, and the coal capacity 10 tons. The special equipment will include Ulster special staybolt iron, Little Giant blow-off cocks, Jerome metallic packing for piston rods and valve stems; main driving-wheel centers cast steel, main driving boxes of cast steel, Latrobe driving tires, Tiger bronze bearings, monitor injectors, Nathan triple sight feed lubricator, C. W. Pickering springs, Peerless No. 1 babbitt metal, standard couplers, magnesia sectional lagging, Leach's sanding device; tender frame, 10-inch channel iron; New York air brake front of all drivers, and for tender and train with Sargent combination brake shoes.

Ten-Wheeler—Having cylinders 20 x 26 inches; driving wheels, 63 inches diameter; and will weigh 152,000 pounds, of which 118,000 pounds will be on the drivers. The boiler will be of the extended wagon-top type with radial stays, and a working steam pressure of 200 pounds. The tubes will be of charcoal iron, Tyler brand, 2 inches diameter, 13 feet 4 inches long; firebox, 120 inches long, 42 inches wide; double-riveted mud ring; tank capacity for water, 5,500 gallons, and the coal capacity, 10 tons. The special equipment will include Ulster special staybolt iron, Little Giant blow-off cocks, Jerome metallic packing on piston rods and valve stems, driving-wheel centers cast steel, main driving boxes cast steel, Latrobe steel driving tires, 3½ inches thick; Tiger bronze bearings, monitor injectors, Nathan triple sight feed lubricator, C. W. Pickering springs, Peerless No. 1 babbitt metal, standard couplers, magnesia sectional lagging, Leach's sanding device, tender frame 10-inch channel iron; New York air brake for drivers, tender and train, with Sargent combination brake shoes.

The best weight for rails continues to be a live question, as we understand some of the 100-pound sections have not been satisfactory.

The Pullman Palace Car Company are now building for the Lehigh Valley Railroad six new passenger coaches which in interior and exterior finish and arrangement will eclipse anything heretofore built in this or any other country, in the way of passenger cars used on regular trains for the accommodation of the public. These new cars will be run in the Black Diamond Express trains between New York and Buffalo, and will replace the coaches now used in these trains—themselves models of comfort and luxury, but considered by the company to be not good enough for the Black Diamond Express, and which it has been considered necessary to replace, with the end in view of keeping ahead of all competitors in affording the public accommodations which cannot fail to be appreciated to an extent that will occasion increased patronage, and consequent increased revenue.

We have recently received several circulars from the International Correspondence Schools, of Scranton, Pa., relating to the work being carried on by the schools. This correspondence-school idea was originated by Mr. T. J. Foster, manager of the *Colliery Engineer*, and the phenomenal success attained is due in a great measure to his energy and excellent management. The correspondence school originated from the demand made by the miners of Pennsylvania for education to help them to pass the mine law examinations. Th y naturally applied to the *Colliery Engineer* for help and the mining correspondence school proved so successful that the system was extended to other departments. They have now 150,000 students enrolled, and the numbers are growing every year.

Mr. E. Pennington, general manager of the Minneapolis, St. Paul & Sault Ste. Marie Railroad Company, sends us a record of one of the Schenectady compound locomotives, No. 502, on the "Soo" road, between Harvey and Camden Place, details of which are as follows: Engine, 502; engineers, MacKay, Ball and Taylor; conductors, Leonard, Mathews; departed from Harvey, 6:05 A. M.; arrived at Camden Place, 6:10 P. M.; time consumed in making run, including stops, 12 hours 5 minutes; number of cars in train, 9; tonnage of train, 349 6-10 tons; number of stops, 55; average miles per stop, 7.14; maximum speed, miles per hour, 67; average speed, miles per hour, 52. It will be noted that this is a continuous run, such as these engines make regularly. It is also reported that hot driving boxes are practically unknown on these engines.

The American School of Correspondence send us an interesting account of a technical journal's defence of the correspondence method of instruction, which had been attacked by an Eastern daily. This is also corroborated by students of the school, who are greatly pleased with it. There is no doubt as to the value of correspondence schools when the instructors are thoroughly competent, as is the case with both the schools advertised with us.

Mr. George H. Heafford, general passenger agent of the Chicago, Milwaukee & St. Paul, has had a boy's dream of going from Milwaukee to Paris by an all-rail route, and in his waking moments he expresses the belief that he will make that trip before he is called hence. He proposes to get somebody to build a railroad from the most northerly connection in Canada or in the United States through Alaska to Bering Strait, and thence across that narrow channel by bridges, and get upon Russian territory in Asia and follow the Siberian Railway to Moscow, and thence by the established routes, wherever he may want to go in Europe. Among the improvements he expects to see carried out in connection with his long journey is a trip under the English Channel, through a tunnel which he expects to see built between France and Great Britain. He expects that this great journey will be accomplished within ten years, and that we may be here to see it.

People are coming to appreciate the wasted labor there has been in calling out all the wipers from the engine house to turn every engine that comes to or leaves the engine house. The talk used to be that it was merely interrupting the wipers, and their time did not count for much. The truth is now spreading that the work of wipers on engines has as much value as operations that are counted more important. So there is now a wide-spread movement in favor of motors for operating turntables. It is easier looking for a good turntable motor than it is finding it. To those engaged in this search we would say, apply to Mr. A. S. Phillips, roundhouse foreman, Baltimore & Ohio Southwestern Railroad, Cincinnati, O., or to Mr. T. S. Inge, master mechanic, Southern Railway, Columbia, S. C., and ask them to send particulars of what they are using.

There are a great many double-headed axle lathes in different railroad shops, but they do not appear to be as popular as it was expected they would be. Most of them do little more work than the single-headed lathe. We found one exception lately in a double-headed lathe in the shops at Spencer, N. C., where one man turns eighteen axles in ten hours. They may be doing better in other shops, but we have not heard anything about it.

The season for flat wheels is now upon us. Look out for water in main reservoirs, snow and ice in dragging hose, and hand brakes left set.

We have received from the New York Air Compressor Company, 120 Liberty street, New York, a copy of their illustrated catalogue, which is a very attractive pamphlet. It contains illustrations of all the air compressors made by the company and a lot of well digested information about compressed air which will be found interesting reading by those who have anything to do with this method of transmitting power. There is a section of "don'ts" dedicated to all users of compressed air, which is a digest of good sense that ought to be widely read. Send for the catalogue and say that we advised you to do so.

The Ajax Manufacturing Company, Cleveland, O., have issued a book which they call "The Ajax Red Book." The purpose of the publication is to let people know something about the machines they make for manipulating iron in short order. The specialty of the company is making forging and forming machines, and this book contains illustrations of upsetting and forging machines, bolt-heading and open die rivet-making machines, bulldozing and bending machines and a l ng list of others. Eight pages are devoted to illustrations of the work turned out by the machines, and this part is well worth study by the men responsible for getting forgings made as cheaply as possible. Besides that, there is a lot of tabulated information about bolts and nuts wh ch will be found very useful. Shop foremen and others interested in such machines can secure the book by writing to the company and intimating that LOCOMOTIVE ENGINEERING advised them to do so.

"A New Industrial Situation" is the name of a book recently published by the Westinghouse Machine Company, Pittsburgh. It gives a great deal of interesting information about gas engines and gives many facts to support the contention that gas engines driven by gas fuel is one of the rapidly approaching motive power changes. The belief is also expressed that in the near future gas will be used for all heating and culinary purposes. Under this clean heat medium the vision is seen of London and Chicago, Sheffield and Pittsburgh, Glasgow and Cleveland, Manchester and Cincinnati, the worst smoke-smothered cities of the world, being freed from the taint of black smoke. The book is finely illustrated, is well printed on double-coated paper, and has an introduction written by George Westinghouse. Those interested in gas engines should send for it.

The regular annual meeting of the United States Metallic Packing Company was held at their office, 427 North Thirteenth street, Philadelphia, on February 12th, and the following were elected directors of the company: John Reilly, Charles Longstreth, Godfrey Rebmann, Robert K. Cassatt and Rudolph Ellis. The annual statement presented at the meeting was the most satisfactory in the history of the company. Mr. John Reilly was elected president and treasurer; Charles Longstreth, vice-president; and Elliott Curtiss, secretary.

The peculiar injector connection shown on page 34 of our January issue is the invention of Mr. A. Wirth, of Parsons, Kan. Any further information concerning it can be obtained from him.

A small pamphlet called "Primary Air-Brake Instruction" has been prepared by Mr. David Holtz, master of machinery of the Western Maryland Railroad, for use of trainmen. The pamphlet contains only about 2,500 words, but it gives a very good idea of the construction and means of caring for the air brake.

We are informed by the Falls Hollow Staybolt Company that they have lately received large orders from the Baldwin Locomotive Works, the Southern Railroad, the Atchison, Topeka & Santa Fé; the Union Pacific, and a variety of other roads for their staybolts. They have also received orders from Harlan & Hollingsworth and a number of other shipbuilders, which show that the hollow staybolts are becoming favorites with those who have care of marine boilers.

One of our correspondents in a recent issue said that he uses Trojan grinding compound to grind out bushings, and now all the men working on repairs of air brakes want to know what the compound is made of and where it can be bought. We do not know what the composition is, but we are aware that the Trojan grinding compound is made by M. C. Hammett, Troy, N. Y., maker of the Richardson balanced valve.

By the first of next April the completion of a new extension of the Burlington Railroad system will open up an entirely new section of country—a territory never before accessible for lack of railroads, but which is wonderfully rich in mining, grazing and agricultural possibilities. The territory is on the North Platte River, in a district famous for the richness of its grazing pastures.

The Standard Tool Company, of Cleveland, have favored us with their new eighty-page catalogue, which shows their drills for wood and metal, taps, reamers, milling cutters, twist drill grinding machine, cotters, riveted keys, etc. Aside from the showing of the goods manufactured, which are of interest to any mechanic, there are tables of drill speeds and metric equivalents to our drill sizes.

Locomotive Engineering

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A Heavy Grade.

We are accustomed to thinking of a 90-foot grade as being heavy, as in fact it is; but we show with this a 13½ per cent. grade, or 712.8 feet per mile. Of course, it is not dependent on adhesion alone, but is combined with a rack rail.

This is one of three engines built for the Cia Minera de Penoles by the Baldwin Locomotive Works, to whom we are indebted for the photograph. The road is 2 feet 6 inches gage, and runs from Mapimi, Mexico, back into the silver mining district of the the adjacent mountains, and is used in getting the ore to the smelter.

The grade varies from 9 to 13.6 per cent. on the rack portion of the road, which is about three miles long, the Abt system of rack being employed here.

The engine weighs 26 tons in working order, and can push 18 tons up the maximum grade at six miles an hour. This load is usually made up of three cars, two empty and the third loaded with supplies. Coming down the mountain, it can control a load of 36 tons on the worst grade. Two of the driving axles have clutches which can lock the carrying wheels so the locomotive can be used as a regular engine for switching at the terminals.

A HEAVY GRADE IN MEXICO—712.8 FEET PER MILE.

Heat Value of the Volatile Gases.

The combustion of each pound of hydrogen gas, if it combines with 8 pounds of oxygen taken from the air, produces about 50,000 heat units, or enough to raise 294 pounds of water from tank temperature to the boiling point. It will be noted that 1 pound of hydrogen calls for 8 pounds of oxygen (2 to 16) for perfect combustion, while each pound of carbon required only 2⅔ pounds of oxygen (12 to 32). As the hydro-carbon gases are released at the top of the fire, it is difficult getting this very large volume of air needed for combustion to the proper place, unless means are taken for admitting air above the fire.

We recently had the pleasure of seeing both the copper-covered cars of the New Haven road. They have been in service about two years, and have never cost a cent for outside work such as painting. As will be remembered, the outer boards are sheathed with copper, which is allowed to tarnish and is not touched. It makes a good-looking car, and as the sheathing only costs about $75 a car, it is an economical investment. It is the invention of Mr. W. P. Appleyard, the master car builder.

Adventures of an Engineer in Tropical America.

BY W. D. HOLLAND.

SIXTH LETTER.

In the course of two years Puerto Barrios changed from a mere jungle and swamp to the most thriving and busy port on the Caribbean Sea, and a better class of society influenced the railroad men to consume less alcoholic liquors and more quinine as a preventive against the dreaded fever. The wife of our contractor, Mrs. Miller, had made her home in the port, and hers was a beautiful mansion, at the very border of the sea, which soon became a much coveted resort for recreation and enjoyment for all Americans on the road, for the hospitality of the hosts made it pleasant for everybody. Mrs. Miller also deserves to be credited with a remarkable improvement in the sanitary institutions of the place; the hospital service became better regulated and skillful physicians were appointed, which precautions did away with the formerly inevitable necessity of measuring a man on his landing for his "wooden overcoat." Our undertaker, an experienced professional, used to meet the steamers at the wharf and in a very businesslike manner took the length and breadth of each individual, so as to have his coffin ready when needed, for the extreme heat of the tropics necessitated speedy burial of the malaria victims, and a man in the best of health was liable to take sick, die and be buried inside of twelve hours. This fact being well known, most of the white travelers from the United States and Europe submitted to the gruesome performance, with grim composure, of being measured, but many others felt their spirits sink at the thought that their coffins were already made, and to keep up courage would indulge in the excessive use of stimulants, as was the case with my friend Fairchilds.

It was amusing to watch the undertaker, who was an expert, take the dimensions of 150 niggers in as many minutes, when some of them had a good joke on hand, while others resented the operation, exclaiming: "Don't you measure me, white man; I isn't gwine to die here; I'se gwine to be buried in South Car'lina;" and the undertaker would coolly advise him to lose no time in sending for some South Car'lina mud so as to have his wish gratified. In fact, very few of the Southern negroes ever had a chance of returning to the land of Dixie, the greater part of them were claimed by fever and hard work and lie now mouldering in the grim, but beautiful, Monkey Hill. However, thanks to the latest improvements, the death rate was greatly diminished, and the port presented quite a cheerful aspect. Railroad and government officials, with their families, invaded the town during the winter months, and steamers from New Orleans and New York called regularly once a week, also occasionally an American or British man-of-war. The officers and passengers were at all times entertained in grand style at the Miller mansion, and to me it seemed almost incredible to realize that but a few hundred miles away the national costume consisted of a straw hat and a cigar, as it did at this very place a couple of years ago. Now pretty cottages appeared alongside the beach, and as the railroad rapidly advanced the traffic increased in proportion.

The banquets that were now given to the president and his staff or to the naval officers differed to a great extent from the dinner Roberts and I partook of at the Alcalde of Hielo's two years ago. There were now silk hats and dress suits and low-necked dresses for the ladies, and I felt thankful once more that I did not follow Emin Pasha's example, and resign the gayeties of civilization in exchange for a life among Central American savages.

Everything now went down to business like in the States, and instead of christening the new locomotives on their arrival from the North with champagne, they were now merely consecrated with oil.

The christening of our first engine, "Rufino Barrios," was quite a memorable act, and as to all probability none of my readers have ever seen a locomotive christened, it might interest them to hear how we celebrated the event. Mr. Miller telegraphed me from Gautemala City to have a little ceremony over the new engine after she had been set up, in honor of the beginning of a new era in Central American railroading. At this time there was but one white lady in the port, the wife of our auditor, Mr. Boissevain, and I asked her to act as sponsor, to which she kindly consented. My friend Billy Mahoney, of California, who was to be the engineer, had left nothing undone that might contribute towards decorating the engine, and there it was, gorgeously fitted up for the occasion, with silk American and Gautemala flags, ferns and orchids, such as are only known in the tropics, with the pilot bar set up straight, and hanging from a golden string was a bottle of "extra dry Mumm," to be pulled by a cord attached to the cab and broken over the pilot. The platform was well adorned with flowers, as were also the cab for the first lady who was to move the first engine destined to connect the two oceans. When everything was ready Billy Mahoney was the proudest man in Central America, and I telephoned Mrs. Boissevain and her attendants that we were waiting. She climbed the cab, and with one hand on the throttle and the other at the cord, broke the bottle of champagne over the pilot, with the words: "I christen this first locomotive of the Guatemala Northern Railroad Rufino Barrios," at the same time moving the engine, that at this moment seemed to all present the embodiment of future progress and prosperity. In this manner, in the presence of a great number of government and State officials, the ceremony was ended, greatly enjoyed by everybody except my boss boiler maker, Jack Reddington, who fairly shed tears at the breaking of the bottle to see such good stuff wasted, where it might have been used for a better purpose.

Those early days in Puerto Barrios were beautiful, no doubt, and I often wish I could recall them; but time went on, and the railroad was pushed towards the capital as fast as labor, money and machinery could push it, so there remains little more for me to tell of my Central American experiences, unless it would be to mention the hanging of some desperado, not unlike the incidents formerly frequent in the Western States, or the suppression of a mutiny among the natives. At the end of four years, on account of sickness in my family, I was obliged to leave Guatemala, and embarked for New York on the British steamer "Anerly." When the scene of my four years' work, trials and hardships disappeared from my view I felt kindly towards the place, and at the same time it gave me a sort of satisfaction to think that I was the first American who dug an artesian well or introduced compound locomotives in Central America, besides standing the sickly climate for such a length of time. For those of my readers who think it of interest I will still mention that the average wages for mechanics and engineers in Guatemala is seven or eight dollars, silver, a day (at that time a silver dollar was worth sixty-five cents in gold, but has since greatly decreased in value). The cost of living is higher than in the United States, on account of the high duty on all imported articles of food; but hard and fatiguing work is unknown. All things are taken easy, and a man has a better chance of enjoying his life.

Knowing these facts, my visit to the United States was but a short one, and after calling on some friends in Chicago, I spent about a fortnight in San Francisco, where I had the pleasure of meeting my old friend William McKenzie in the Oakland shops, one of the greatest master mechanics that our country has yet produced. The month of July saw me back in New York and well supplied with letters of introduction to people and railroad companies in South America, I embarked on a pleasure trip for the beautiful land of the Incas—far-off Peru.

One of our friends, who is evidently opposed to pooling, sends us a clipping of a race between a regular flyer and a special on a road in Kansas. This shows that it took four engines 3 hours and 25 minutes to make 135 miles, owing to hot boxes and other engine ills. It certainly isn't a good showing, but may not be entirely due to pooling.

Cleburne Shops of the Santa Fe.

Some very extensive, as well as expensive, new work is now being done on the line of the Santa Fe route in Texas in the way of changing the grades, cutting down the hills, filling up the hollows, straightening curves, building new shops at more central locations, and in many other ways getting the road in shape to do a larger volume of business at a considerable less expense per ton-mile for all classes of traffic. The main shops were formerly located at Galveston; they were of wood and not large enough. The main shops are now located at Cleburne, 200 miles from the northern end of the district and about 317 miles from the southern terminus, so that they are more central.

These shops are very substantially built of stone, and while part of them have been occupied for six or eight months they are just about completed. The roundhouse is of stone, has twenty-four stalls, has stone walls in all pits, with brick bottoms, well drained and heated with steam. There are two drop pits, with air jacks with ball bearings under the travelers. The coal chute is of wood, with thirty pockets. A sand house, 30 x 40 feet, is next to the coal chute. The oil house is of brick, 26 x 44 feet. The machine shop is of stone, 120 x 340 feet, with ten pits for engines and three for tenders, the machines being ranged along one side of the shop. They are driven by a Bates-Corliss engine, 18 x 42 inches, which gets steam from the central boiler house, 40 x 88 feet, where there are three large Scotch boilers.

Across the transfer table pit, which is 63 feet wide and 340 feet long, is located the boiler, blacksmith and tin shops and brass foundry under one roof. This building is 90 x 340 feet. There are twelve fires in the blacksmith shop using Buffalo down draft to carry away the smoke. Three steam hammers are busy. The boiler shop has a 75 horse-power Westinghouse engine. The coach shop is of stone, 90 x 160 feet, with paint shop and wood mill, each 90 x 180 feet, adjoining it. Each of these buildings is stone. A large Corliss engine similar to the one in the machine shop runs the wood mill. The freight car repair shed holds twenty-four cars, and is 80 x 300 feet. There is also an extensive repair yard for light repairs. This yard is piped with air, so that air machines can be used wherever they will do the work economically. Compressed air is used all over the shops, roundhouse and yards. It is furnished by a very large Rand compressor. All the machines in the shop that need one have an air hoist, some on runways fastened overhead so heavy work can be easily handled, others have derricks fastened to the posts or overhead framing.

All the buildings are whitewashed overhead and on the side walls with a fireproof whitewash. The roofs are, most of them, of concrete or tar and covered with small shells, instead of gravel; as these shells are white, the buildings look as if the roofs were painted also.

Water is expensive here, especially soft water; so all the condensed water from the steam heating apparatus is trapped and led back to the boiler room and goes to the boilers again. The exhaust steam from the engines is led into three old locomotive boilers immersed in a big tank of water, where this steam is condensed and the water used over again. The water supply is from a drive well 1,120 feet deep, lately finished. It is pumped by compressed air, a pressure of 220 pounds being necessary.

Mr. James Collinson, superintendent of machinery is very particular about the neat and orderly appearance of everything in the entire plant. In the machine shop we noticed a space marked out on the floor between the machines, and all material was kept inside those lines. About 170 engines are in service on this part of the system. They are pooled, and a fair share of the freight trains are double-headed. The system of looking after the engines in the shop is very complete. An inspector is employed who inspects the engines, in addition to the reports made by the engineers. This same inspector also looks out to see that the work is done, and keeps a record of all hot boxes, and, if possible to find out, the cause of their getting hot, condition of packing, etc. All the records of work done by the engines while in train service are kept in ton-miles, and it is a very satisfactory way of locating the earning power of a locomotive and train. These ton-mile accounts are all kept by the transportation department, daily sheets being made out. Trains are all made up by the tonnage rating; in the case of double-headers the number of tons each would draw singly is added together for the double train. On some roads the tonnage the two engines would draw in one train is somewhat less than the tonnage they would handle in two trains.

In the way of betterments to the track the grades have been cut down, so that in some places where a 17 x 24-inch engine formerly handled only 380 tons the load is now 1,100 tons. In many places the old line has been abandoned and a new one laid out which is shorter and better in every way. Some of the hills have been cut down and the material used to fill the hollows, so that the grades are very easy. When the improvements now under way are completed, the average train load can be increased a number of times over the old rating. This will also help out the running time of the passenger trains. The track is being ballasted with a very fine article of gravel on the south end; the north end has broken stone. All the ties used here are treated with a preserving liquid, which makes a pine or cedar tie as hard as an oak one, and when thus treated their life in service is three or four times as long. The plant for treating ties and other timber is located at Somerville.

A new roundhouse and running repair shop is now being built at Bellville. When it is finished the division point will be moved from Sealy, where the engine house is now located.

These many improvements have cost up into the millions of dollars; but Galveston will some day be a great trade center, and the Santa Fe Company will get it all back in the increased traffic.

Photo by A. H. Chamberlain.

BOSTON & ALBANY AND NEW HAVEN 9 A. M. TRAINS LEAVING NEW SOUTH STATION, BOSTON, MASS.

Prehistoric Ruins of Mexico.

Our friend Barrett, of Pueblo, Mexico, has favored us with photographs of some very interesting ruins that have been found in Mitla, State of Oaiaca, Old Mexico, shown on the opposite page.

An exterior view of the hall of Monoliths is shown in Fig. 1, which is in the best state of preservation of them all. It was used as a dwelling by the early Spaniards. Under the windows the mosaics have been removed by relic hunters, who seem to have no regard for buildings of this kind, no matter what their value to the historian.

An interior view is shown in Fig. 2, and the remaining pillars can be plainly seen. They are about 12 feet high and 7 feet in circumference, and stand in the center of the main hall. They were hewn from solid rock.

An inner chamber of the hall is seen in Fig. 3, and shows entrance to another chamber, Fig. 4. The large cap-stone over door was broken by an earthquake. It is supported by masonry of recent date, to prevent its falling. Cap-stones are nicely carved. The panels in walls are laid with most intricate mosaics of small pieces, carved and fitted together. So nicely is this done that it requires a careful examination to convince one that they are not all in one piece.

Fig. 5 shows all that is left of East Temple, the remaining pillars standing like sentinels guarding against further destruction. The walls are about 6 feet thick, the centers being filled with cobble stones and clay. This clay bakes very hard in the sun, but is easily dissolved in water.

The last view, Fig. 6, shows a tomb which was discovered by Professors Saville, of New York, and Batres, of the National Museum of Mexico. It contained two very large human skeletons, indicating that the original inhabitants, or at least the ones who built these magnificent buildings before our history began, were much larger than the race now existing there. The excavators shown on top of tomb are Zapoteca Indians, a native race of this district.

There seems to be no trace of the builders of these fine specimens of architecture and carvings, and it probably must ever remain a source of mystery and speculation. They were discovered by the Spaniards during their conquest of Mexico, about 1520 A. D. Portions of them were destroyed by them to obtain materials for building churches. Though they were doubtless doing their duty as they saw it, it is to be regretted that they did not leave us more information as to them and their builders, if they knew themselves.

Humiliating a Cowboy.

In the Western grazing regions the appearance of a railroad train is a welcome distraction to the monotony of a cowboy's exi tence, and the members of that class of rough riders are always ready to make the best of the transient excitement which the train brings. The cowboys will ride for miles to reach a passing train. They yell to the engineer and often call him by name, shout the compliments of the day in a free and airy fashion to the passengers, kiss their hands to pretty girls that may be seen at the car windows and ride a lo-ing race as long as they are within hail of the train.

In Western Kansas there is a long, steep grade on a leading railroad where the ascending trains toil up so slowly that it is common for the cowboys to ride alongside and hold a conversation with the trainmen or passengers. One cowboy, named Red Pete, became remarkably free in taking liberties with trainmen and passengers. He would ride up beside the engineer and ask him for a chew; he would joke with flagmen and conductor and joke with the butcher. In summer, when most of the car windows were open and the dust-covered passengers were lolling out of the windows to catch a breath of vitalized air, Red Pete would grasp the hand of any verdant-looking man and squeeze till the owner yelled. To attractive members of the fair sex he was exceedingly liberal with expressions of devotion, and he seldom paid a visit to a train without inviting some lady to stop off and become the wife of his bosom.

One day as Pete was riding alongside of the Overland Express he made some facetious remarks about the personal appearance of a raw-boned miner, with hands nearly the size of a No. 3 coal scoop, who was leaning out of a car window. Pete bore no malice with all his fun and mischief, and wishing to finish up in a friendly way, he held out his hand to shake with the miner before leaving. The miner grasped Pete's hand with wonderful cordiality, and displayed extraordinary interest in the cowboy's personal affairs. He wanted to know all about the grazing business and how much a month a cowboy got for riding about the plains scaring the prairie dogs. Then he offered a pair of boots for Pete's pony, which was declined, then he tried to effect another trade. Meanwhile the train had passed the summit and was working into speed on the down grade, but the miner clung to the hand of the cowboy and encouraged him to spur up the gait of the pony. In a minute the train was beyond the pony's pace, and Pete, following his hand which the miner still froze to, was pulled over the pony's head and hung dangling from the side of the car, like a weasel nailed to a barn door. A small creek flowed alongside of the track and it still contained pools of muddy water. When the miner had got all the fun he wanted out of Pete, and the trainmen and passengers had laughed themselves hoarse, the miner dropped Pete into one of the slimy puddles. The last the trainmen saw of the cowboy was a statue of mud shaking its fists and a crowd of cowboys who had followed the procession, rolling on their horses' backs in fits of laughter.

Another Automatic Scheme.

One of our Philadelphia friends sends us a cut of the Strohm automatic device for running a locomotive with a laborer in place of an engineer. Ever since railroading began, there has been a tendency to do things automatically, but it has been found in every case that brains were necessary to success.

This device is of the electrical persuasion, with a dynamo run constantly by a small rotary engine and all the fixing necessary to make a cab look like the running gear of an electric wagon.

The inventor allows the engineer to use his different appliances under normal conditions, and only wishes to aid him in taking a nap, or otherwise neglecting things, when it gets in its fine work by blowing whistle, closing throttle and applying brakes.

There are many places where the automatic schemes are doing work we never dreamed possible, but those who are familiar with locomotives know that the cab of a modern engine is not conducive to gimcracks of this kind.

Three Kinds of Large Cars.

The St. Paul & Duluth Railroad have four cars 40 feet 8 inches long, 10 feet wide and 16 feet 8 inches high. They are two stories high. The lower story of one of them is a kitchen, of another a dining room, and the other two have offices for the foremen and reading rooms for the men. The upper stories of all of the cars are sleeping apartments and filled with bunks. Of course, these boarding cars do not go off their own road into interchange service.

The same road has a line of box cars called the Flour Line, which hold 350 barrels of flour. They are but little longer than an ordinary 60,000-pound box car, but are built very strongly. They carry 75,550 pounds when fully loaded, and are in great demand by the flour shippers.

The Great Northern Railway has a lot of box cars, used in way freight service between St. Paul and Minneapolis and the transfer freight house, that are 57 feet 7 inches long inside, with the ordinary dimensions of width and height. They have two doors on each side, one near each end, like a long baggage car. This gives a chance to load freight for eight different points and have it first out next the door when the car comes to the platforms. We do not see why two side doors will not expedite the loading and unloading of way freight from local trains at way stations. For this service cars 40 feet long would do the work all right. Convenient methods of handling merchandise at way stations would do away with a good many delays in the train service that cost money.

PREHISTORIC RUINS IN OLD MEXICO.

1. Hall of Monoliths.
2. Interior View, Showing Stone Pillars.
3. Inner Chamber.
4. Another Chamber.
5. All that is left of East Temple.
6. A Tomb and its Excavators, Zapoteca Indians.

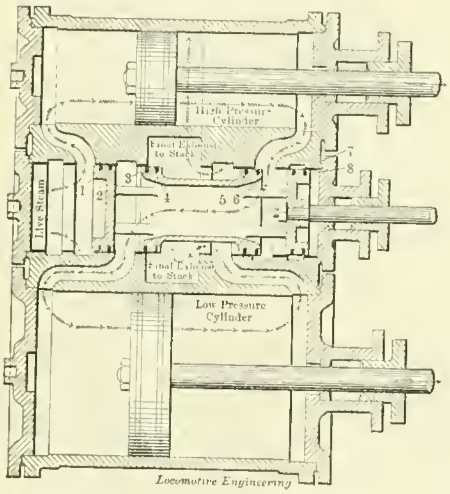
Blows in Baldwin Compounds.

BY ALONZO B. KINYON.

Not having seen anything in our mechanical papers on the above subject, and believing that any information on the matter will be of interest to the many earnest readers of LOCOMOTIVE ENGINEERING, I submit the following as the result of several years' study and experience while handling this type of engine.

In the first place, it is essential to know whether there is a blow or not, and then to locate it. Now, by blows we do not mean a mechanical, or rather an unmechanical, movement of parts, such as a pound, but the leakage of steam past the various packing rings in the valve chambers and cylinders.

A peculiarity of certain blows in a Baldwin compound is that they may readily (and often are, by the beginner in handling this type of engine) taken to be the result of some mishap to the valve motion, causing the engine to go lame. For this reason we say that it is essential to



SECTION OF VAUCLAIN CYLINDER.

know whether there is a blow or not, and a little careful inspection on the part of an engineer will soon determine this. When a lameness is heard in the exhaust the engineer should carefully note each exhaust when the engine is working slowly, and determine at what points the inequality or lameness occurs. If the engine has two equal exhausts and one very heavy and one very light, or goes on three legs as we say, the probability is that we have a slipped eccentric, a loose strap, a bent blade, or some mishap to the motion which would cause the lameness, any one of which will be detected by a careful inspection of the motion.

If the exhaust shows an alternate heavy and light one, we may safely conclude the trouble to be in the valve or cylinder packing, or in the starting valve. If in the latter it is caused by the rods and levers, the same being of improper length, due to striking some obstruction along the track and bending them, causing the starting valve to stand other than central when the cylinder cock lever is in compound position, and allowing live steam to enter low pressure cylinder. If by putting lever in live steam (extreme back position) this inequality disappears, it will indicate the trouble to be in the starting valve connections.

If we do not find that the inequality in the exhaust disappears by this operation we may reasonably conclude that the trouble lies in the packing, though not positively so, as the movement of the lever may have closed the valve on the defective side and opened the one on the other, still giving an unequal exhaust, but in reverse order. This would, no doubt, be noticed by the observant engineer, who could further satisfy himself by getting down and examining the position of the starting valve lever, which should stand perpendicular to the rail when the cylinder cock lever is in central position. If found all right, we may safely conclude the trouble to be in the valve or cylinder packing. But which? There's the rub.

The alternate light and heavy exhaust before referred to may be due to one of two conditions when not caused by starting valve out of order, and the first thing to do is to determine which condition is present, though it is possible for both to be.

In the accompanying sketch the left cylinders and valve chamber are shown, as laid out by the Baldwin Company in their instruction book. For clearness in illustration the valve chamber is shown between the high and low pressure cylinders instead of behind one or the other, as in actual arrangement. The engine is nearing the quarter, and the valve, working full stroke, has traveled off the ports. Now, with the starting valve closed, open the throttle and admit steam to the high pressure cylinder, reverse the engine, and we have live steam in both ends of the high pressure cylinder and in the back end of the low pressure. Now get down and raise the front cylinder cock, and if steam blows in any considerable quantity it will indicate low pressure packing or inside valve rings, 3 and 4 or 5 and 6, blowing. If by putting reverse lever in center notch, thus covering ports, the blow continues, it will indicate that *valve* rings are leaking, while if the blow ceases it is the cylinder packing. Of course, if the blow continues with the ports covered, both the valve rings and cylinder packing might be leaking, but this is an unlikely condition, and I have never seen such a case. This test is similar to the test for cylinder packing blowing in a simple engine.

Now to test the high pressure packing. With the engine in the position shown, admit steam to the front end of the high pressure cylinder, keeping the starting valve in central (compound) position. Now slack off the union nuts in the live steam pipe at each end of the high pressure cylinder, and if steam appears at each opening thus made it will show that high pressure packing or valve rings 1 and 2 or 7 and 8 are leaking. If the blow stops by putting the reverse lever on the center it will indicate high pressure cylinder packing blowing; if it continues then the valve rings are probably leaking, though, as in the case of the low pressure, it may be both, but is not at all likely. If the blow continues from but one end, it is the valve rings on that end. This latter might also be said of the low pressure test. If we raise both cylinder cocks in the trial and steam comes from but one end with the valve central, of course in this case it is understood to be the inside rings 3 and 4 or 5 and 6.

There are several other combinations of valve ring blows which might be possible, but the above are the most frequent, so we will not mention them for fear of confusion.

In the foregoing we have taken the trouble to have been located on the left side. When a blow occurs in actual practice it is difficult for the beginner, and even an experienced runner may make a mistake in locating the blow on the proper side of the engine. A little careful observation will, however, enable one to do this accurately.

When the irregularity in the exhaust is first noticed let the engineer decide whether his engine is made strong or weak by the defect. If stronger, the trouble is on the side from which the heavy exhaust comes; if weaker, it is from the side of the weak exhaust.

When cylinders are provided with indicator plugs it will be more convenient to remove them than loosening the union nuts in the live steam pipes in testing high pressure packing.

The presence of broken pieces of packing in the cylinder cocks, causing them to stick up, is pretty sure indication of defective valve packing on that side, as the many ports in the valve chamber bushing, together with the eight packing rings on the valve, present many more chances for breakage than are present in the cylinders. In the majority of cases the trouble will be found in the valve packing, and in making examination when there is a case of doubt the valve should be examined first, as it is less trouble to pull, and the defect is more apt to be found there.

I have frequently been questioned by beginners in handling Baldwin compounds, and even by men who have been running them for some time, as to how live steam is gotten into the low pressure cylinder when the starting valve lever is pulled clear back. For the benefit of such I will say that the live steam pipe, midway in which the starting valve is located, is tapped into the steam way leading from the valve chamber to the high pressure cylinder at either end, and when we pull the lever clear back we allow some of the live steam from the receiving end of the high pressure cylinder to flow around to the other end and take the course of the exhaust steam to the low pressure cylinder, and the amount of power gained thereby increases as the speed decreases, due to the longer time given for the small inch pipe to carry the live steam to the large cylinder. When the starting valve lever is central this valve is closed, and only exhaust steam from the high pressure cylinder goes to the low. In the extreme forward position the valve is opened to the atmosphere, as well as opening communication between the ends of the high pressure cylinder, thus acting as a drain or cylinder cock to the high pressure cylinder, and the cylinder cocks are also opened in the low pressure cylinder.

Neat Oil Room.

The usual oil barrel or tank with the faucet at or just above the bottom is getting to be a thing of the past. The first step was to use a rotary or other pump to fill the tanks with, instead of dipping or pouring, as of old.

The modern way is to have large tanks in the cellar and only the faucets and drip pans in the room above. The oil man operates the same as before, but the oil is forced up by air pressure, and he has nothing to do but open the faucets, and possibly regulate the air pressure occasionally. From 4 to 10 pounds pressure is used, according to the weight of the oil to be handled—the heavier the oil the greater the pressure.

With the tanks in the cellar it is also easier to fill them from the car than in the other case. It's a big improvement in every way, and is cheaper in the end, where air can be had.

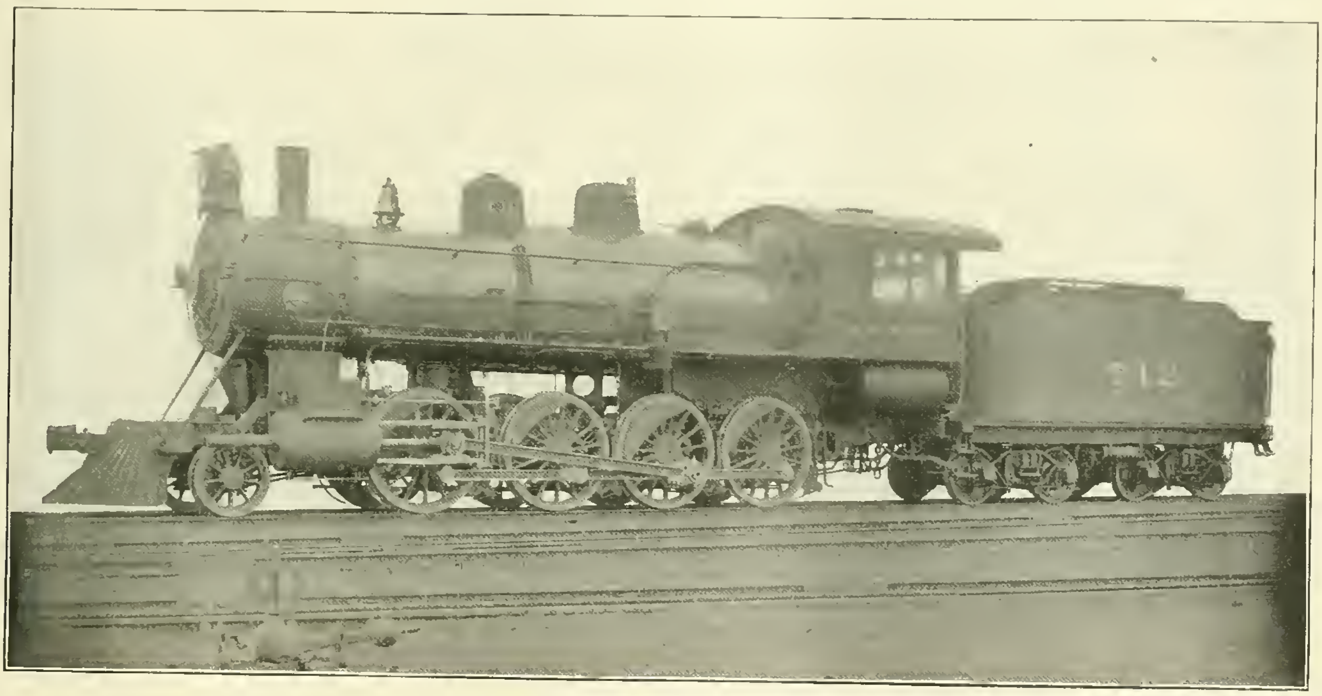
Brooks Consolidation for Lake Shore & Michigan Southern.

The annexed illustration shows one of twenty-five consolidation engines recently built by the Brooks Locomotive Works for the Lake Shore & Michigan Southern Railway. That railway is noted for its easy grades and straight alignment, consequently the mechanical officials have not gone in for a very large consolidation engine, and the total weight of this one is 168,000 pounds, of which 149,000 pounds are on the drivers.

The wheel base is 25 feet 6 inches, and 17 feet 4 inches are driving wheel base. The center of boiler is 9 feet 2 inches above the rail, and the stack 14 feet 10 inches.

The engine has cylinders 21 x 30 inches, and the driving wheels are 62 inches in diameter. The tractive power of the engine is about 36,000 pounds, and the ratio of tractive to adhesive power is about 4. The boiler is called the Brooks improved wagon top style, and carries a working pressure of 200 pounds per square inch. The diameter of the boiler at the front is 64⅛ inches and at the throat 76 inches. The firebox is 121 inches long, 41 inches wide, and an average of 73½ inches deep. There are 312 tubes, 2 inches in diameter and 15 feet ¼ inch long. The tubes provide 2,454 square feet of heating surface, the firebox and arch tubes 230 square feet, making a total of 2,682 square feet of heating surface. The grate area is 33.5 square feet. The journals of the main driving axle are 9½ x 12 inches, the wheel fits are made ¼ inch greater diameter than the journals. The other journals are 8½ x 12 inches. The main pin is 6½ x 6½ and the coupling pin 7¼ x 4½ inches. The main pin diameter in wheel fit is 7⅝ inches. The steam ports are 19 inches long by 1⅝ inches wide, the exhaust port being 2¾ inches wide. The valves are Allen Richardson balanced, with a maximum travel of 5¾ inches. The outside lap is 1 inch and the valve is set 3-32 inch blind.

Among the special equipment are American brakes for drivers, with Brooks improved arrangement of shoes on back of wheels, Westinghouse brakes for tender and train service, Westinghouse 9½-inch pump, Nathan sight-feed lubricators, Ashton safety valves, Monitor injectors, French springs, United States metallic packing, Gould couplers, Pratt & Letchworth steel castings, Sargent brake shoes.



BROOKS CONSOLIDATION FOR LAKE SHORE & MICHIGAN SOUTHERN.

Mourning for a Hawk.

All last summer and during the early fall the attention of passengers on the Black Diamond Express was called to a hawk which every day flew along by the train rushing through Lehigh Valley on its approach to Mauch Chunk. The train crew said the bird was racing, and bets were always pending on which would reach a certain point first. The hawk never won, but renewed the contest daily, and, as though acknowledging defeat, would mount into the air and swirl round for the backward flight. One day, a few weeks ago, it flew on with the train, as usual, when suddenly it was seen to halt and quiver, then fall. It was found soon afterward, shot through the head by some wanton huntsman. All the train hands mourn this bird as though it were a personal loss.—New York *Press*.

Rhode Island Consolidation for Big Four.

The engraving shows one of ten consolidation locomotives built by the Rhode Island Locomotive Works for the Cleveland, Cincinnati, Chicago & St. Louis Railroad. The cylinders are 22 inches in diameter by 30 inches stroke. Driving wheels 56 inches in diameter, weight 181,000 pounds, of which 167,800 pounds are on the drivers. The boiler is of the extended wagon top type, with radial stays and a working steam pressure of 200 pounds. The tubes are of charcoal iron, No. 11 gage, 2 inches outside diameter, 13 feet 8 inches long. Firebox 119⅛ inches long, 41⅛ inches wide; mud ring double riveted and machined. The tank is quite a large one, having a water capacity of 6,000 gallons and a coal capacity of 10 tons. The tender frame is channel iron and Fox pressed steel trucks are used. The engine is equipped with American brake. Jerome metallic packing is used on valve stem and piston rods.

RHODE ISLAND CONSOLIDATION FOR BIG FOUR.

New Fuel for Automobiles.

So much has been said and written recently about the danger of benzine and gasoline for automobile vehicles that any other power produced at an equal or less cost should be worth consideration. Dr. Benjamin is of the opinion that alcohol, properly used, is the safest and most economical fuel for steam and explosive motors that can be found. From a scientific standpoint it cannot be excelled. He says that in Moscow and St. Petersburg heavy automobile trucks, carrying loads up to four or five tons, are in constant use, their motive power being derived from alcohol motors, and that this fuel—almost absolutely ethyl-alcohol—can be made according to the Villon electrolytic process for about eight cents a gallon. By that process a very pure alcohol is made, chiefly from limestone and coke. The process is simple, and the ingredients used in the production are cheap. In comparison with any petroleum product, alcohol possesses enormous advantages of cleanliness and freedom from all disagreeable odor. To prevent it being used fraudulently for other than its intended purposes, it is possible to add to it a flavoring of some of the amyl compounds, which give it a nauseous taste, making it impossible to use it in the manufacture of liquors, yet not impairing its usefulness as a fuel. "Alcohol does not generate gas," added Dr. Benjamin. "I believe firmly that it is the coming generative power. It is cheap, not bulky, not normally explosive, and can be carried on vehicles without danger. It can be manufactured in this country, under present conditions, for about thirteen cents a gallon—provided its use will be permitted. In Russia large trucks of four and five tons are operated at a cost of only $1.05 a day. These carry the alcohol in tanks, which measure only four feet by about thirty inches, situated beneath the body of the truck."—New York *Sun*.

New Sound Steamer.

The New Haven Steamboat Company have recently added a new boat to their fleet. It is the Chester W. Chapin, almost a mate to the Richard Peck, one of the noted flyers of the sound. The new boat is 324 feet long, 40 feet molded beam and 17 feet 2½ inches depth of hold.

The furnishings are rich and pleasing, the staterooms nicely fitted and very convenient, and as the boat is both comfortable and fast, it is already a favorite. There are two triple expansion engines—one on each screw—having cylinders 24, 38 and 60 inches in diameter by 30 inches stroke. They develop 4,200 horse-power, giving a speed of 21½ miles an hour. The builders were the Maryland Steel Company, Sparrows Point, Md.

General Correspondence.

All letters in this department must have name of author attached.

Reminiscences of New England Motive Power.

[A LETTER TO W. A. HAZELBOON.]

In the January number of LOCOMOTIVE ENGINEERING I read with pleasure your article on "Old Colony Locomotives." Woodworth's immortal poem begins: "How dear to my heart are the scenes of my childhood," and surely these are objects almost as dear to the eye and mind as is the "old oaken bucket" or the wildwood. To a mechanic or engineer a familiar machine or locomotive of his boyhood strikes a chord of tenderness. As a boy, living in South Boston, I remember every one of the noble list of engines you name; and right well were they named, as they ran into the very country where our grand history began with the earnest labor of earnest men and women on a stubborn soil. Did you ever see a grander train than the Steamboat Express, finer, cleaner engines, or enginemen more proud as it pulled out of the Old Colony Depot every evening for its run to Fall River, there to connect with the boat? There was the "King Phillip," brass glistening like pure gold, perfectly clean in every part, between the drivers a bright brass plate, upon it "Manchester Locomotive Works; A. Blood, Agent"—yes, a Blood engine in every detail. Of course, you remember the English compartment car they ran; if you do not friend Willis does. Predictions plenty then that we would adopt the English style of coaches; looks different now. But they were careful of an engine then—no plugging to stop it; the fireman stood at the tender brake, and was glad to do it. It would have hurt him as much as his engineer to misuse the engine.

The Old Colony then had a roundhouse in South Boston; all the pits under one high dome roof; no smoke jacks at all. The smoke found its way, or was supposed to, out a central opening. Some of the smoke has found its way out, but most of it has stayed in, and is there yet all these years. The last time I looked in the atmosphere was as dense as a Scottish mist. In those days, you know, engines were wiped; it was not business to have a fine, clean passenger train and allow it to be pulled by a forlorn looking locomotive, reeking with grease and accumulated dirt of months—an unenviable contrast.

I can see now, in my mind's eye, friend Willis as he ran the old "Dighton." I was a schoolboy then. By the way, I would like to see a picture of some of the earlier Old Colony engines—those inside connected machines. Some were built by the Bridgewater Iron Works. Some at South Boston had straight stacks and a spark-catching box just behind the cylinders, between frames. There were the "Bridgewater," "Neponset," "Quincey," "Kingston," "Braintree" and others. They pulled thousands of brave boys in the sad days of the '60s on their way to Southern battlefields. There were two at least that had a single pair of drivers with trailing wheels. Have any of the "old boys" on the Old Colony got a picture of them?

Well, friend Hazelboon, I will apply brakes and sidetrack, or "Uncle Angus" will cancel my run.

GEORGE H. BROWN,
Dist. M. M., C., M. & St. P. Ry.
Dubuque, Iowa.

ENGINE TOO HEAVY OR BRIDGE TOO WEAK.

Steam Heating of Cars.

I have had some experience in the steam heating of passenger trains. I do not see much in your valuable journal about steam heat, and thought I might be able to contribute a little in this line that would be of interest to at least a few of your readers. We on the Pennsylvania road have the vacuum pump located in the bulk-head of tank and use the return system, which requires two lines of pipe under each car, with a hose connection between the cars. The pipe on left-hand side facing locomotive is the supply pipe, and the one on the right side facing locomotive is the return pipe. Cocks located in cars control the flow of steam into car and return the condensation to the return pipe where the suction of pump takes hold of it and brings it back to locomotive, discharging it into tank. So far as I know, we have pretty good success. Sometimes in very cold weather there is a case of freeze-up on some trains, but if everything is properly attended to, so as circulation can be kept up, I do not see how it could freeze up. I have had good results, as I never heard of any complaint of any train I was firing freezing up. I am sorry I cannot send you a drawing of our pump, but if you see fit to publish this, those who have anything to do with steam heat on the Pennsylvania Railroad will understand me.

Open wide the main valve on boiler and admit steam to reducing valve, which should be set to show a pressure of 60 pounds on the pressure gage on locomotive, as it takes this amount to run the pump successfully. This may not be enough in extremely cold weather, hence it will be necessary to increase the amount to 80 pounds or more.

Say the conductor or inspector asks for 20 pounds; if the exhaust of the pump will not show a pressure of 20 pounds in the supply pipe, it will then be necessary to open the train valve or live-steam valve, as some enginemen call it, to increase the pressure in supply pipe, so steam gage in bulk-head shows 20 pounds. Now, if it takes 60 pounds to run the pump, and you allow 20 pounds to pass through train valve, you reduce the pressure 20 pounds against the pump, which makes it necessary to increase the pressure on engine 20 pounds, making 80 pounds. The water valve on condensing chamber should be used as little as possible; from one-quarter to one-half turn should be sufficient. I find on a long train of eight or twelve cars if valves in train are not open too wide on front end, I do not have to use water valve, but on a short train of three or four cars requires more water to keep the pump cool. The less water it requires to keep pump cool the better circulation you will have; the more water it takes to keep pump cool, the less water will be taken out of the train, as the pump would have all it could do to take the water from the tank and exhaust it back into tank again. Then the water of condensation lies in the pipes back in train, pipes becoming water-logged and freeze up, making it necessary to cut all hose on "return" side. This compels train crew to set valves in cars for "direct" steam, which makes it unpleasant on a local train on account of steam escaping at drip cocks under each car, and on frosty mornings a little steam makes a big cloud, hard to penetrate with the eye. The cause of pumps getting hot requiring lots of water at water valve is caused by the regulating valves in forward end of train being too wide open. This allows steam to get into "return" pipe in almost the same state it left pump, instead of being condensed, and the pump will get hot, causing a fall of pointer on vacuum gage and pump races, and is liable to break the reversing valve rod. The valve motion of the vacuum pump is the same as that of the Westinghouse 9½-inch air pump.

C. L. Marker.

Waynesboro, Pa.

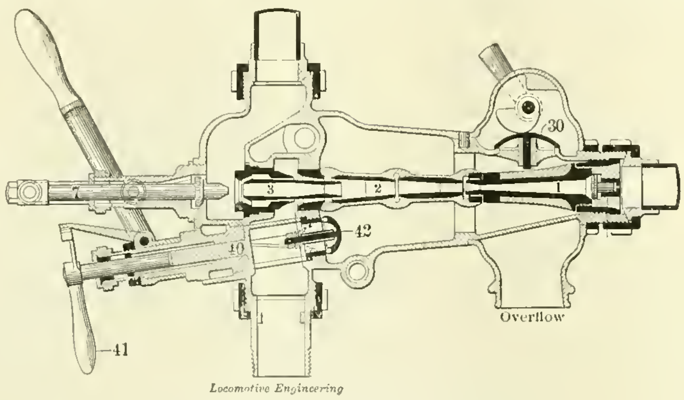
Sellers 1887 Class N Improved.

This injector is automatic and, being composed of almost stationary parts throughout, the decline of it is gradual.

It scales up, requiring an acid bath to clean it.

The range of delivery decreases with scale so it throws scarcely any water.

If the end of spindle 7 becomes worn so it fits too loose in steam nozzle 3, then when you attempt to pull it out a short distance for priming steam enters nozzle 3 and the injector does not prime readily.



SELLERS 1887 IMPROVED INJECTOR.

If spindle 7 should break off behind valve when valve was on its seat it could be readily detected by the ease with which the handle moved.

If the valve broke off on starting the injector, the chances are that it would fall down below steam nozzle, and when you went to shut it off you would be compelled to shut the steam valve off at boiler. You could start it probably by barely breaking the joint on steam valve until it primed, then giving steam enough to work it.

Should cam shaft 36 break, cam 31 will fall down and prevent waste valve 30 from raising when you go to prime injector; and again, sometimes it will work all right, and probably the repair man will overhaul all the injector (except the overflow) several times, each time remarking that the injector was all right but the engineer did not know how to work it.

There is only one place to grind in when the steam blows out of the overflow, and that is valve on spindle 7, or its seat.

If the leak is neglected it will rattle overflow valve 30 constantly, and make it leak so when injector is working it will throw scarcely any water, on account of drawing air in at the overflow.

If valve stem on valve 42 should break it would be a hard matter to get the injector to prime, especially if combining tube 2 is limed up bad.

A. A. Lindley.

Why the Locomotive Goes.

In your February issue of Locomotive Engineering I notice under the head of "General Correspondence" an article entitled "Why the Locomotive Goes," by John Rickie. This article, in attempting to set at rest the question of the position of the fulcrum in a driving wheel, makes matters worse by advancing a theory which I will endeavor to show is incorrect.

Concerning stationary engines the author states that there is no discussion as to the position of the fulcrum, "the power at all times being applied at the crank pin, the fulcrum being constant at center of axle," and that "when the crank is on top the wheel is pulled around and when on bottom it is pushed around." This is true, but he goes on to say that "When we come to place the wheel on the rail conditions alter entirely, for the wheel can only be made to rotate by a succession of pulls at a part of the wheel, while it is held at another part."

On the contrary, conditions are not altered at all. For example: Suppose a belt to press against the wheel of a stationary engine in motion; it will be propelled in the same direction as the circumference at that point, the *fulcrum still remaining at the axis of the wheel,* no matter whether the crank is at top or bottom. Now, let the belt be the rail. Then, since motion is only relative, the locomotive can be considered a stationary engine propelling the rail, while the wheel rolls along it, still revolved by alternate pulls and pushes on the crank pin. Therefore, the fulcrum always remains at the axis of the driving wheel.

Continuing, the article reads: "A push at no part can make it rotate forward, no matter whether you are standing on the ground or *sitting on the machine.*" This latter statement is wrong, as may be proved by referring again to the stationary engine. For, according to the author's own statement regarding a stationary engine, "When the crank is on top the wheel is pulled around, and when on bottom it is *pushed* around." Now, the push exerted by the piston is exactly the same as the push of a person seated on the "machine," or engine, since in both cases it is clear that the reaction is on the engine's framework. Therefore, the wheel *will* rotate forward if a push is exerted on the crank when down. This can be proved by experiment with a movable vehicle.

Ellis W. Bentley.

Brooklyn, N. Y.

Long and Short Valve Travel.

I notice an article in the March issue written by A. McL. Conveth, referring to something that F. Gleason wrote about long and short valve travel. I am glad to see this matter come up, as I am in favor of short valve travel myself. And if I should be asked why the only reason I could give would be that I never ran a short-travel engine that was not a good one. Some two years ago I wrote to our superintendent of motive power, Mr. A. E. Mitchell, and gave him my views on short travel. He gave it an investigation by having short travel, 5 inches I think, run on the valve motion machine, one of the best machines in use, and sent to all the division master mechanics for their opinions. The result of the investigation was they could not see any advantage in short travel. Mr. J. H. Moore, master mechanic of the Buffalo division, said it was an old idea of years ago, and had been exploded long ago; but he did say from an engineer's standpoint it stood good yet, as an engine could be graduated finer in the cut-off. While that did not satisfy me, still it was a little consolation to even concede that the engineers knew when she had done the finest work.

We have got some Rogers consolidated engines, and their eccentric is on the No. 2 shaft, and the main rod is coupled to the No. 3 wheel. No. 3 wheel has got to move far enough to take up lost motion in its axle box as well as the lost motion in the main connection side rods and connection of side rod to the No. 2 wheel, and with all this lost motion they are, without any exception, the smartest engines on our division, their valves working free and clear, every exhaust as distinct as a gun shot. it is generally supposed by the men away up in mechanics that the average engine driver, as we are sometimes called, and some call us enginemen, but Webster is more kind and calls the man that runs an engine "engineer;" but no matter what we are called, we are not credited with knowing much; but it is at least conceded we know a good working engine when we see it or hear it, and the great majority of the engineers will tell that the short-travel engine is the one that does its work smoothest.

A. McL. Conveth thinks the short travel working slower acts like a blow on the fire. Now, I always thought the reverse. Owing to the throw of the eccentric on the long travel being greater the sweep is greater; that is, it swings in a greater radius and its revolution would be slower. Like a large driving wheel compared to a small wheel—the large one would have the smallest piston travel. The small eccentric will certainly make its revolution quicker than the large one. I always thought that is where the advantage was in a quicker motion, but I would like to hear others express their opinion on this subject.

A. J. O'Hara.

Port Jervis, N. Y.

[As the eccentrics move with the axle, both the large and small ones make their revolution in the same time. The small one moves the valve a shorter distance, and as this is done in the same time, must move it more slowly than a large eccentric.—Ed.]

Patentee of the First Metallic Gland Packing.

The genius who patented and first used metallic packing on the locomotive is J. T. Wright, who was for many years an engineer on the old Atlantic & Great Western. His packing is known here as the "Wright," but commercially as "W. S. Metallic." Please give him credit, as that is about all there was in it for him. His present address is Knoxville, Marion County, Iowa.

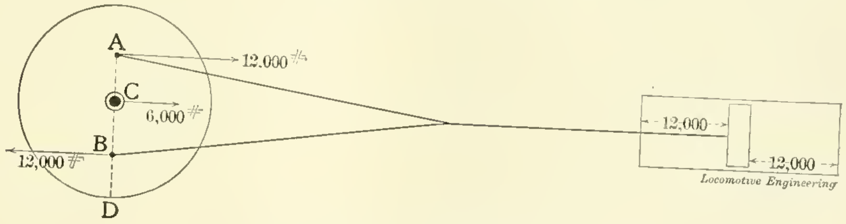
W L. Wright.

Galion, O.

Why the Locomotive Runs.

In the February issue I notice "Why the Locomotive Runs," and will try to throw a little more light on this subject.

Let $A\ C = C\ B = B\ D = 1$ foot, and let the pressure on the piston be 12,000



WHY A LOCOMOTIVE RUNS.

pounds; this at *A*, the pin on top quarter, 3 feet from *D*, is 36,000 pounds, and divided by lever arm *C D*, 2 feet, gives 18,000 pounds at *C*. To oppose, there is 12,000 pounds on back cylinder head. This, subtracted from 18,000, leaves 6,000 pounds acting at *C* to move the engine forward.

Now take pin at *B*, the bottom quarter; 12,000 pounds over lever arm of 1 foot is 12,000 pounds, and divided by *C D*, 2 feet, gives 6,000 pounds at *C*, acting backwards. To oppose this, there is 12,000 pounds on front cylinder head, which would leave 6,000 pounds acting at *C* to make an engine go forward. So we see that the same force is exerted to move the engine forward on top as on bottom quarter.

But as the train hangs against the front of the axle and the force on the top quarter is against the front of the axle, and the force is acting on the bottom quarter to push the axle away from the front of the box the efficiency of the engine would be greater on the bottom quarter on account of the difference in friction to be overcome in the two positions,

W. J. Wilcox,
Division Foreman.

Los Angeles, Cal.

What to do When Axle of Consolidation Engine Breaks.

I see in the March number of Locomotive Engineering that you would like to hear from engineers in case of an axle breaking on a consolidated engine. As I have had an experience of thirty years, running nearly all kinds of locomotives, I will say just what I would do in this case, and in fact what I have done. When engineer is out on the road, away from everybody who knows anything about the machine he is running, he is then in the position of master mechanic and superintendent; he is the whole business for the time being; he is the man that the company looks to to clear the road and get the wreck out of the way and let other trains pass. Do this, even if you have to suspend some regular rule that you have for disconnection.

The first thing to do is, get your rods out of the way by driving out bolts at knuckle joints and front end of main rod. Get wheel and rods out of way just so they clear, and let them stay there. You cannot load the wheel with the help you have, so when the way freight comes for the wheel, they can load the rods at the same time. Run your No. 4 wheel up on a wedge just as high as you can get it. That will raise your frame of Nos. 1 and 2 boxes. Now block on top of those boxes; put all the blocks in you can; you will not make them too high. Now run No. 4 off the wedge and run No. 2 on the wedge, then block up on top of No. 4. Run No. 2 off the wedge, and if the pilot clears the rail well, she is high enough. The supposition is, you have no jack with you. Get a piece of rail, 12 or 15 feet long, for a lever; put some blocking of stones, old ties or new ones, any kind of blocking at the braking end of your axle and raise it just as high as you can against the set of the spring; block under the cellar, and you are ready to go. The journal may cut a little on the edge of the cellar, but that don't matter in this case, as the axle will be scraped anyhow. But if it was a tire-striped or wheel-center brake, then we would take out the cellar and put in a block and save the journal. Screw your side rods up; start easy without slipping, if you can, and use the brake to stop. Do not reverse to stop, and if you have train you can handle easily, take it to the nearest side track, so the road will be clear; but if you cannot start easily, do not pull the engine hard to do it; let some other engine push it to the siding. You cannot do the engine much harm if you handle her right. You may shear bolts in the straps a little, but it is better to do that than block the road.

There is a consolidated engine on the Erie that has the eccentric on No. 2 shaft and the main rod is coupled to the No. 3 wheel. On engines coupled in this way you would have to run the side rods up if you run them at all. In giving my plan of blocking up, I said when she was high enough you were ready to go. I did not mention the disconnection of the valve stem and blocking crosshead, etc., taking it for matter of course that that will be done; and if bolts are not twisted up badly, this job should be done in, at most, one hour. A. J. O'Hara,

Engr. Delaware Div. Erie R. R.

Port Jervis, N. Y.

Sleeping Car Built in 1837.

Some years ago a very interesting railroad relic was destroyed, of which a description may be acceptable to the readers of your valuable paper.

The relic referred to was the first sleeping car that was ever built. This car was called the "Chambersburg." It was built in 1837 by Embry & Dash, of Philadelphia, for the Cumberland Valley Railroad, and placed in service by this road in the spring of 1838. It served to make the journey for passengers from Pittsburgh and the West comfortable and expeditious. Chambersburg was then the farthest railroad station West, this point being reached by a stage line. Weary passengers were glad enough on reaching Chambersburg to enjoy the comfort of a sleeper as far as Harrisburg, which was the Eastern terminus of the "Chambersburg." This car was continued in the service between Chambersburg and Harrisburg until supplanted by others more modern in their appointments. The length of the car was 36 feet and it was 8 feet wide. The interior finish was maple and the exterior chestnut. The arrangements for sleeping were such that twelve gentlemen and twelve ladies could be accommodated. The car was separated by a partition into two compartments, with a door in the partition leading from one compartment to the other. In the gentlemen's compartment there were a few cross seats. There were also two seats on either side running lengthwise with the car, which at night formed the lower sleeping berths. The back of these seats, when pulled into a horizontal position, formed the second tier of berths. The third berth was formed by boards fixed by hinges above the windows, which were hooked during the day to the roof and let down at night to a horizontal position. In the ladies' compartment were three seats on either side. A perpendicular piece dropped toward the floor from the side of these seats nearest the aisle, which, when brought to a horizontal position, formed a berth for two persons out of each seat, thus accommodating twelve persons.

The car was remodeled in 1848 and made into a day coach. Shortly afterwards it carried Zachary Taylor, the President at that time of the United States, from Harrisburg to Chambersburg. The car was considered exceptionally fine. Three models of this car were made by the father of the writer, who was in the employ of the Cumberland Valley Railroad from 1838 to 1895, and who is now in his eighty-first year R. G. Shaffer.

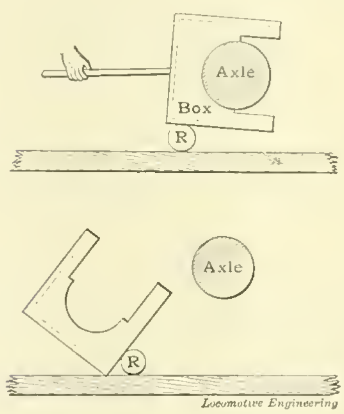
Chambersburg, Pa.

Handling Driving Boxes.

With all the rigs I have seen for handling driving boxes, from the overhead air hoist to the young crane that clamps on the axle, I haven't found one yet that beats the old way. Perhaps the designers of the various labor savers had not seen the old trick, but were lifting the boxes, or having helpers to do this.

The old way is shown in the sketch, and almost explains itself. The plank is blocked up to the right height, so that when the box is on a roller it will just slip over the axle in good shape. The roll is usually a piece of 2-inch pipe.

The upper view shows the box tipped



HANDLING DRIVING BOXES.

down on the roll *R* just ready to roll back for further examination and scraping. The lower view shows it rolled back and being tipped down.

With this rigged up properly a man can handle driving boxes all day and not do any heavy lifting to speak of. He can also do the work faster than with the other rigs. Frank C. Hudson.

Tombstone, Ariz.

A Marine Locomotive Boiler.

I notice in the design of marine boiler on the Santa Fe several things that make me want to ask questions—because I once lived in New England probably.

Why is the heat, after going through the flues and doing some useful work, turned adrift to the tender mercies of two *outside* return pipes? It is true that the gases are no hotter than goes out the stack in the ordinary engine, but it does seem queer to run it back the whole length of the engine, with no chance of even heating feed water.

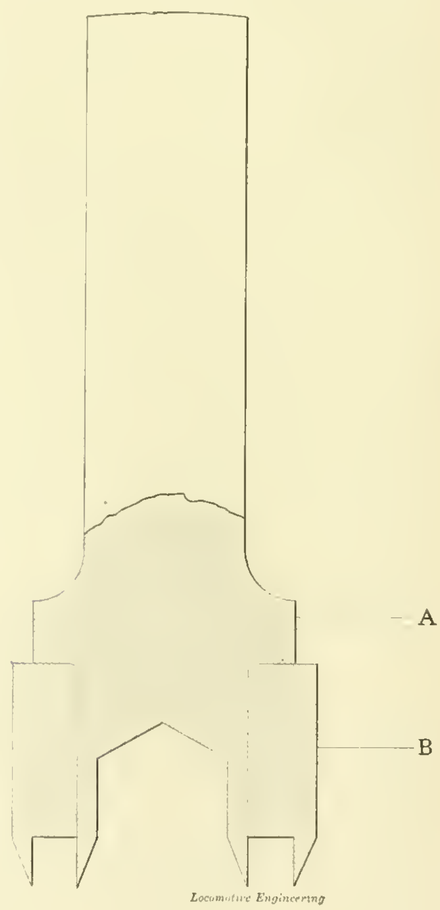
Then, too, it seems like imposing on the engineer and fireman to put the return heat box or chamber in the cab. It's like adding the heat of the smoke arch to that of the fires. This roundabout journey for the gases must make a stronger draft necessary, which means smaller nozzles and more back pressure. At least, that's the way it looks to an engineer. I haven't quite got used to the ¾-inch fire sheet either; seems to be rather thick metal to get heat through.

Frank Gleason.

Richmond Hill, N. Y.

Convenient Gasket Cutter.

Enclosed is a sketch of a gasket cutter which I have found very convenient. It is made of tool steel and not hardened.



Ring *B* is a nice sliding fit on *A*, which, being partially removed from *B*, facilitates the removal of the gasket after it is cut. In the smaller sizes it will be found advisable to make the inside cutter of a third piece and drive it into part *A*, which does away with the tendency to break in the shoulder.

The idea is not patented.

G. S. Hale,

Foreman A. B. Car Dept., S. P. Co.

Oakland, Cal.

The Youngest Admirer of Locomotive Engineering.

During the past six or seven years that I have been a subscriber of your paper I have several times read accounts of young admirers of LOCOMOTIVE ENGINEERING. I now claim to have the youngest on record. For some months I have noticed that he seemed to enjoy the pictures in LOCOMOTIVE ENGINEERING as much as any of his picture books, but when the March number arrived during my absence he laid all others aside and wanted "papa's book and wanted it cut open." When asked what he wanted it for he said: "To see papa's cars," and there was no peace in the house until he had seen all the pictures. As he is only twenty-two months old, I think I have a right to claim the banner. I can say that if he gets as much enjoyment out of it while looking at the pictures as I get information concerning railroad matters he must have good reason for preferring it to anything else. G. W. TITCOMB.

Saco, Me.

[We regard this as a case of inherited taste.—Ed.]

All Coons Alike in the Dark.

One of the Northern Pacific's most popular and trustworthy engineers (Honest John Bannerman) nearly lost the "Honest" part of his name recently. He had been laying off and was called on short notice to go out on another man's engine —the "379"—her crew being out piloting the general manager special over the road. John rushed to the roundhouse and saw an engine standing where the "379" should stand, as John thought, and as he flew by the tank he observed indistinctly in the moonlight the figures "3" and "9," but he neglected to observe a "3" sandwiched between the two figures. John registered out and hurried back to the engine, put on his overalls and with oil can, wrenches and torch proceeded to "grease the pig." He had just finished oiling and was wiping off the oil can, and incidentally his brow, when the hostler happened along, and, seeing what was up, asked John what the h——l he was doing there with that engine. John replied, "Going out on her, of course." "No, you ain't," said the hostler; "you are going out on the '379,' and that is the Idaho division '339.'" John rushed to the tender, noticed his mistake, and wilted. They tried to keep it quiet, but it was too good to keep and "the gang" caught on, and they "joshed" John till he blushed like a girl, but said nothing. When the M. M. was let into the secret and asked by wire for an explanation, John rose to the occasion and wired back, "All coons look alike to me."

Hope, Idaho. L. D. SHAFFNER.

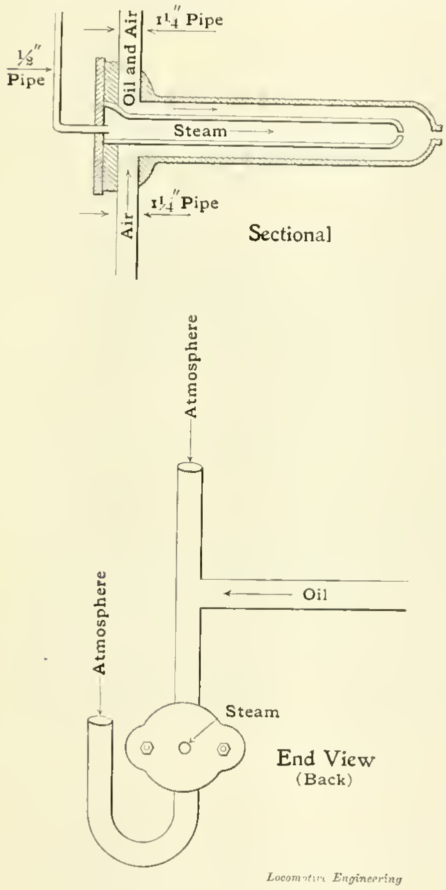
Our chart of a modern eight-wheel locomotive showing all the parts, and with a table giving the names, is again for sale; price 25 cents. The original plate was burned, but we have had a new one made.

Burning Oil on Locomotives.

Nature, in bestowing her gifts, gave to California almost everything in her line, from chicken-soup springs to gold. A good Californian never tires of making you remember the same. But there was one article she seemed to have forgotten—that was coal.

There are a few deposits in the State, but they, from a fuel point, do not amount to much. Heretofore the native would have very little to say when the fuel question came up.

Nowadays he takes you by your coat button and gives you something like this: "Coal? Why, coal was not good enough for California. Nature gave the finest fuel



SHEEDY-CARRICK OIL BURNER.

she was able to prepare in her laboratory. To show that she favored this State, she did not store coal in the earth and condemn armies of men to labor in the dark caverns to take it out; but gave vast amounts of the essence of coal that could be obtained from the surface," etc., etc.

Oil (fuel oil) has been found in most of the counties lately. Last year's production was about 476,500 barrels. This year will exceed last in production by thousands of barrels. Coal at $4.80 per ton makes it profitable to change a locomotive into an oil burner, with oil at $1 per barrel; or in other words, oil at one dollar is somewhat cheaper than coal at $4.80 to use on a locomotive. Fire losses are less using oil. This amounts to something in this dry country.

The Santa Fe uses about 33,000 barrels per month on their locomotives in this section. The Southern Pacific is using some 30,000 barrels, and talk of changing more engines at once. The firemen find less hard work, yet they are almost as tired at the run's end as when they used coal. It looks like "sit on the seat and move the two small levers one way for steam, the other way for *no* steam. The first trip he finds the last fireman had plenty of steam and no black smoke (you get black smoke with oil about the same way you get it with coal); that he had to watch the engineer, and every time he changed his lever or throttle he had to change his fire, not too soon or late. He must keep his eye on the water in the boiler, must know the road, keep the oil thin in cold weather so it will flow, know the thin oil, the thick oil, etc. In fact a good fireman on an oil burner must keep his eyes open, for he can make or waste more for the company than he even could on a coal burner.

The Southern Pacific Company uses the Sheedy-Carrick burner. It has, by test, shown that it will evaporate as much water in a given time, get all there is in the oil in line of combustion, and is built on lines of simplicity, which is all that can be said of any hydrocarbon burner. The burner is about 10 inches long, 1½ inches thick and 4 inches wide; the oil opening is ¼ x 3½ inches, being large enough so any lint, etc., reaching it will pass to firebox.

The inside shell is made somewhat shorter and works something like an injector. Steam passing through the inside box to knife-blade opening strikes the oil and air; at once it becomes atomized, inside the burner, and is thrown into the firebox. When first firing throw in a bit of burning waste; when the atomized oil strikes it you have a fire. It is somewhat on the blowpipe and lamp flame style, but on a large scale.

In order that this flame will not strike the flue and side sheets there is a brick wall built up all around the box to above any point the blast might strike. To change a coal burner to oil they extend the firebox down a few inches by angle irons on mud ring, place burner just under back mud ring and connect up pipes. In order to burn oil the arch must be just right to give the gases the right curve. If they reach the flues too soon after combustion the water in the gases seems to dampen the flues, black smoke shows up at once, the flues are soon lined with asphalt, and no steam is the consequence. Therefore, the shop forces must use great care in their work in placing arch and burner.

All netting and diaphragm plates are taken out. Exhaust pipe is made half the height of the flues, with a short petticoat pipe. There must be a sharp blast to burn oil. Large area of front end must have small nozzle. If smoke arch is small, as before extension came in, you can use larger opening in nozzle. When engine is working at set speed or power, you run mile after mile and see no smoke. When changing the force one way or the other, there will be a few exhausts of black smoke until the fireman has gaged his fire.

There is a Sheedy-Carrick burner used on the stationary boilers here. To look at the stack any time of the day you could not tell there was a fire within a mile of it. On locomotives a bucket of sand is run into the firebox at hole in the fire door about every 200 miles while working engine hard, to clean the flues.

Los Angeles, Cal. C. R. Petrie.

Valve Motion.

Mr. Henry's remarks in your February number are all right in themselves, but do not really dispose of anything I wrote. The ordinary valve gear does what he claims, but still not so well but that people have tried long ports, long (and therefore quick) travel, and in fact different gears altogether—Joy's, for instance—with a view to improving on it.

There is one remark (middle of right-hand column, page 67) that I admit a captious critic might fall foul of. When I talked of moving the eccentric forward or backward I suppose I had a mental picture at the time of the crank pin being over towards the back center. If it were on the opposite side the terms would have been transposed. H. Rolfe.

Consolidation With Broken Axle.

Referring to the best course to pursue in case of a broken main driving axle on consolidation engine, asked by correspondent in March number, will say: An engine I was running some time ago had this accident happen when about 1½ miles out of terminal, axle breaking off square between box and hub. After looking engine over carefully, I could not see that any of the rods were bent. I decid d to try and get engine back to shop without disconnecting anything, which I did after having pusher engine take train back to yard. After replacing this axle engine was ready for service, no rod work being necessary. Would like to ask if an engineer ever got out of this serious breakdown as fortunately?

V. C. Randolph.

Hornellsville, N. Y.

Watching Details of Engine Running.

I notice with satisfaction the points brought out by my query in regard to the brick arch and attendant leaky flues. It shows conclusively to a good engineman that there are conditions within their control that warrant the use of the arch, and good results will be obtained when the right methods are observed in connection with its use.

One of the main things to be remembered is, that with an arch a much lighter fire can be carried, and there is no need of a thick, heavy load of dead matter on the grates under it to prevent having as bright and hot a fire next the flue sheet as on any other part of the grates; hence, an intelligent manner of firing will obviate this trouble If the fireman is a beginner, it is the duty of the engineer to instruct him in this matter; but if a man who has fired for any considerable length of time, he should know without telling and keep himself posted on correct methods pertaining to his part of the work.

While there are many lectures being read to the fireman of to-day, such as smokeless work, etc., other points which none of the boys has written about were required of me in everyday practice during my years of firing, which I found were possible, and cannot help mentioning.

For several years I fired a small locomotive on a local passenger run, which required sharp work, and, to use our expression, the eye continually on the indicator. My "right bower" was a man of years' experience, thoroughly practical, of few words and eternal vigilance. The return half of our trip was after dark, and shortly after going on the run, he asked me how it would sound to hear it remarked that the "Three-spot" killed a man on a road crossing and the engine crew did not even know they struck him. I said of course it would sound bad. "Then do not open the furnace door approaching a road crossing," was the injunction, "for it blinds the engineer, and you are looking in the firebox, and neither would know if crossing was clear."

Again, on our line, at that time were switch-stands without lights. "Make it a rule to see these switch-stands yourself," was my next admonition, "and should one be wrong, you stand one better chance of living."

My partner was as particular as he wished me to be, and I soon found by watching that he whistled at the posts 80 rods from crossing accurately. I then would drop in a fire that would keep even steam until crossing was passed, and had time to watch approach from my side. This was not hard to do, when alive to business. Boys, how many of you follow this practice? There are other details I would like to talk about, but do not wish to be tedious. I would advise every engineman, however, to read Locomotive Engineering if he wishes to know what the boys are doing. I have every number since January 1, 1888, and prize them very highly. M. D. Corbus.

Muskegon, Mich.

Brick Arches.

In reading Geo. B. Nicholson's article on "Brick Arches," in the March number of Locomotive Engineering, I think he is inclined to lay a good deal of the trouble to the fireman who is on engine equipped with brick arch.

Out here, in the northwestern part of Iowa and the southeastern part of South Dakota, we do not have the best of water to use, and all the locomotives out here on the Chicago, Milwaukee & St. Paul Railway are equipped with brick arches and water tubes for supporting the arches.

We have a good deal of trouble with engines on account of leaky flues and cracked side sheets in fireboxes, but not very much trouble with flue sheets.

There are passenger engines running here, which, when the brick arches are put in, have to have their flues caulked every trip or two. This is on engines that have been out of shop nine months or more. Now, take these same engines and run them without brick arches, they will run two weeks or more without having to have a man go into their firebox with a caulking tool; but they will burn more coal without an arch than they will with one. But if you have to take the arch out every trip or two, it will amount to more than the coal saved.

There is another trouble with engines out here since they have been equipped with brick arches, and that is, cracked side sheets. All the cracks start at or about in line with the brick arches, and extend downward. It is very seldom that you see them above the brick arch.

The water has a good deal to do with the flues leaking; but why is it that they leak very much sooner with an arch than they do without one?

The only reason I can see for it is, when an engine comes into a station, in order to keep her from blowing off, the fire is allowed to burn down, and it has to burn down more with a brick arch than it does with an engine that has none, on account of heat stored in the brick arch; and in starting out four or five shovelfuls of green coal are put into firebox, and as the brick arch has cooled off some, it will take up the heat first—that is, from the fire under the arch.

Now, it cannot be said that the firemen out here do not know how to fire engine with an arch or without one. In order to have good success with or without an arch, you have to keep a light, clean fire in your grate. C. F. Sundberg,

C., M. & St. P. Ry.

Sioux City, Iowa.

Correction of Description of French Engine.

Allow me to mention a mistake in the February number of your valuable review. The French Eastern Railway of France engine is not a four-cylinder compound, but a two-cylinder non-compound engine. The first engine, No. 801, was built at Epernay in 1891, and forty engines—No. 801-840—have been built since. This type is not the actual express standard. The Chemin de fer de l'Est has built last year new four-cylinder compound engines of the de Glehn type, or "Nord type," similar to the Chemins de fer du Nord engines. These engines have been designed after the plans of M. de Glehn, Administrateur-Directeur de la Société Alsacienne de Constructions Mécaniques de Mulhouse. The "Flaman boiler" has been abandoned. The steam pressure of the new engine is 224 pounds per square inch. These engines will be exhibited at Paris this year. CAMILLE BARBEY.

Valleyres 's Rances, Vaud-Suisse.

The McHenry Coal Chute.

Most of the coal chutes in use for coaling locomotives are intended to have a supply for one engine only in them at a time. When the chute is opened all the coal runs out. It is not usual to weigh the coal after it goes into the chute, or pocket.

At St. Paul and various other points on the Northern Pacific Railroad are installed coaling plants which have large pockets that hold from thirty to forty tons. The gate at the mouth of the pocket is so arranged that it can be raised at any time, whether the pocket is full or empty, and closed when a sufficient quantity has run out into the tender. To take the strain of the coal, which would tend to hold the gate solid against the frame it slides up and down in, there are roller bearings between the edge of the gate and the frame. When the engine is placed under the mouth of the chute, ready to receive its allowance of coal, an apron is let down which directs the coal into the tender. This apron does not touch the pocket at any point, as it would interfere with the operation of weighing the coal. The gate is raised, and when the right amount has run out into the tender, the gate is dropped and the flow of coal is stopped. In case a chunk of coal catches under the edge of the gate, it is raised a little to free the chunk and dropped. From experience with coal gates and chunks of coal, we thought it impossible to handle such a gate, but observation of its working shows that it can be done easily.

The pocket is a large bin suspended by four rods, one at each corner. The bin is suspended so that the rods do not come perpendicular, and it swings back against the frame of the structure, with a force proportionate to the amount of weight of the bin and coal. Between the frame of the structure and the bin, at a point where the bin would naturally touch the structure, is a device to weigh the bin and its contents. This consists of a brass can filled with a non-freezing liquid. The can rests against the structure on one side, on the other side is the bin. The weight of the bin tends to compress or flatten the brass can, and this force compresses the liquid, which in turn, through the medium of pipes connecting with a gage located on the front of the chute, shows the weight of the coal. This amount is read before taking out any coal and after taking coal; the difference between these two amounts is the weight of coal that has gone on the tender.

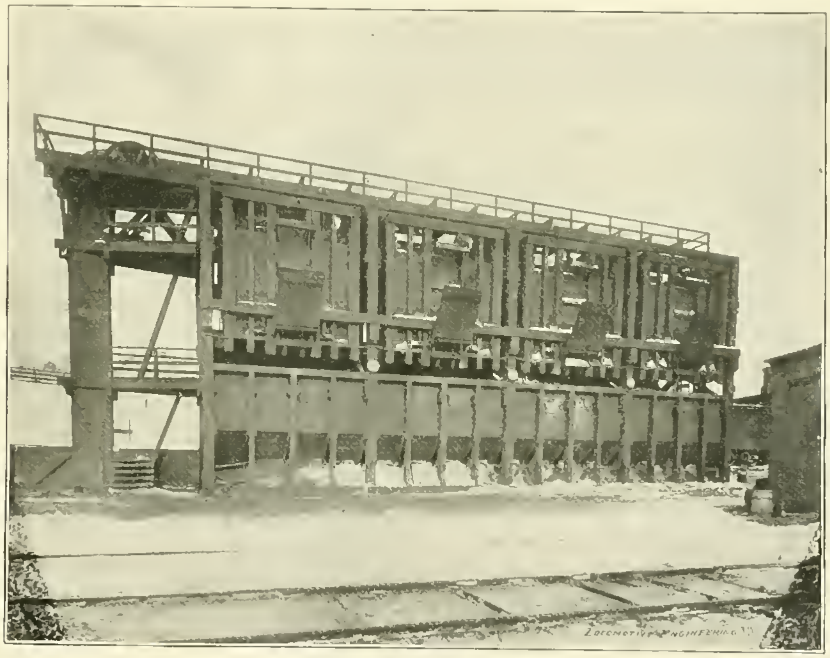
The coal is unloaded from cars on the ground level, and elevated to the top of the bin by a 10 horse-power gasoline engine. The space under the pocket is utilized for a storage bin. Coal can be run into the elevator from this storage bin or from cars, as is desired.

Some twelve or fifteen plants of this kind are now in service and doing excellent work. They are erected by Fairbanks, Morse & Co. The Link Belt Company furnish the elevating machinery.

At the same point in St. Paul—the Mississippi Street engine house—there is an ash-hoisting plant worthy of mention. The ash pit is of the usual depth and has in the bottom a screw conveyor, which, when running, brings the ashes from each end of the pit to the center, where a link belt elevates them high enough to go into a gondola. This is operated by the same engine that runs the elevator for the coal chute.

The ash pit and conveyor has a concrete bottom; the one for the conveyor to the gondola should be plated with steel sheets, as the concrete wears out.

These coaling plants were designed by Mr. E. H. McHenry, chief engineer of the Northern Pacific Railroad. The details have been very carefully worked out, and as their operation has disclosed difficulties they have been remedied. They have one advantage—the weight of coal is not guessed at; it is actually weighed each time any is taken.



M'HENRY COAL CHUTE.

Wit and wisdom are crowded together in "Jim Skeevers' Object Lessons." It is the best book ever offered to railroad men for one dollar.

At the last meeting of the American Society of Mechanical Engineers, the veteran engine builder, Mr. Chas. T. Porter, in his discussion of Dr. Thurston's paper on "The Steam Engine in the Close of the Nineteenth Century," stated that it is a principle of the new engineering that "the boiler furnace shall be independent of natural draft, effectually consuming its smoke, and burning two or more times as much coal per square foot of grate as it could do under natural draft alone, and yet sending off the gases at a low temperature; the boiler being a steam generator, a superheater and a fuel economizer combined." This statement clearly shows Mr. Porter's implicit faith in the future of mechanical draft as a substitute for chimney draft as a means of securing the desired ends.

A Large Overclothing Factory.

The evils of the sweat-shop system are made all the more glaring by comparison with a first-class establishment such as that of Hamilton Carhartt & Co., of Detroit. While this is not the only one which can be called modern, they are so few that each one stands out in relief.

The factory is well lighted, has ample room around it, and has a large shelter for bicycles, which many of the almost 600 employés use in going to and from work. It is gratifying to know that a business of this kind can be run on lines which secure good wages to employés and a fair profit to the owner, as in this case.

The absence of side-rod breakage since the advent of solid end rods was emphasized on a local road the other day. The rod that broke was one of a very few still remaining that had keyed brasses. Solid end rods almost never break.

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Asking and Answering Questions.

There is a growing tendency among many of our readers to apply to Locomotive Engineering for information concerning questions relating to every scientific subject they are uncertain about. Many questions come to this office that we do not consider suitable for answer in our columns, and we always answer them direct by mail if they are accompanied by the name and address of the inquirer. If they are not so accompanied, we always throw them into the waste basket. We are perfectly aware that there are good reasons at times for parties asking questions wishing to keep their identity unknown, but there is no reason why they should not comply with our rule requiring that the real name and address should be known to us, for we never reveal them to others. We are always ready to head the question with any kind of name or initials, so there is no fear that the questioner will be identified from his initials. We think there is useless nervousness about people asking for information trying to keep their identity unknown; but so long as the feeling exists we will always be prepared to respect it.

An impression appears to exist among many people that they must be subscribers to the paper to entitle them to have questions answered. This is a mistake. Our mailing list is too large to be examined for the names of people who ask questions, and there are so many readers who subscribe through news agencies that we could not find out with certainty whether or not a party asking a question was a subscriber even if we wanted to, which is not the case. While writing on this subject we might say the editor rarely knows when a subscription begins or ends, for the mailing list keeps several persons busy, who work on it all the time. When people apply to us for favors that are entirely outside the business that the paper deals with, we would rather that they apply to some one else; but we rarely know if they are readers unless they tell us. Applications sometimes come in which reveal a curious turn of mind in those who are asking favors. It is very common for foremen, master mechanics and others who have lost their position to write asking the editor to put their names on his list, or to make inquiries among his friends if anything can be found for them. The letters occasionally indicate that the writer has not been a reader of the paper, and sometimes they prove that the writer deserves no consideration at our hands.

Our question and answer department is useful to those who require the information asked for, and it is interesting to our readers, or we should not devote space and labor to it. As we wish to make it as useful as possible, we would like people to confine themselves to questions that will be of general interest. A very common thing is for us to receive a question that will be found answered in any good dictionary. For instance, in a recent issue the word "isochronism" was used, and we have received several letters asking what the word means. If people asking for this information would look up an encyclopedia, they would find isochronal as meaning something performed in equal time. The word has come into use for describing mechanical operations, as, for example, the relative movement of piston and valve. Their strokes are performed in equal time, and therefore are isochronal. Questions much more simple than this frequently come to our desk. Our comments thereon are intended to suggest to some of our inquirers how they can easily help themselves to information.

Why Not Try Variable Nozzles?

We are acquainted with a railroad that has a leading division nearly two hundred miles long, and all through passenger trains make the run without taking coal. On the westward trip the engines are noted for full steaming and for their punctuality in making schedule time, while on the eastward trip there is more delay, and "engine not steaming" is a common report. The cause of this difference is in the quality of coal supplied at the two places. At the eastern terminus a good quality of free steaming coal is supplied, while at the western point the coal is refractory, and does not make steam so freely as the other. The coal taken on at the western station having less heat producing qualities than the other must be burned more rapidly to supply the steam required, and as it is harder and does not burn so freely stronger draft must be employed to make it burn with the necessary velocity. It would probably pay this railroad company to haul the coal over the division to make the supply uniform for passenger train engines, but this is not done. The men in charge of the motive power are left to their own devices to make the engines steam. As they are not responsible for the economical operation of the power, they do their best in the simplest way to prevent engines failing for want of steam. This is by making the nozzles small enough to burn the refractory coal without difficulty.

This is a plain case where variable exhaust nozzles could be used with much profit and utility, but trying that means of adjusting the force of exhaust to suit the coal burning in the firebox does not seem to have been considered by the men in charge. The fact is that the use of variable exhaust nozzles seems to be under a cloud, and it does not increase a man's popularity to say that the use of that device would be likely to help railroad men over a bad difficulty. The plan adopted is to make the nozzles small enough to burn refractory coal under the worst conditions.

When most railroad men are spoken to about a variable exhaust nozzle they instantly display feeling that ranges from mild disgust to violent resentment. Most of them are ready to declare that variable exhaust nozzles are in line with loose wheels, roller bearings, feed-water heaters, improved valve motions, and other fallacies that are constantly cropping up to annoy and disgust the men who know that these things must necessarily be failures. Yet an exhaust nozzle that could be regulated in size to meet the varying requirements of draft is one of the most desirable improvements that could be applied to a locomotive. There are greater possibilities of fuel saving in an expanding nozzle that could be easily worked, an arrangement that would be durable and not liable to get out of order, than in any single other improvement that has been tried on locomotives. It is true that hundreds of patented expanding nozzles have been applied to locomotives, and it is also true that most of them have gravitated in due season to the scrap heap. This makes nearly all railroad men ready to condemn variable exhaust nozzles on general principles, but it is another case where the species of condemnation is unsafe and unwise. Many mechanical devices have been repeatedly abandoned because a minor element required for success was wanting, and the providing of that element eventually brought about the desired result.

Those who have seen expanding nozzles used to relieve the intensity of exhaust when a locomotive was pulling hard out of a station are forced to acknowledge that the saving of coal secured was highly important, but the ultimate and supreme difference encountered was in keeping the steam opening from becoming distorted and to maintain the working parts in movable order. The zeal for fuel saving soon wanes, and the difficulties of keeping the mechanism exposed to the action of the hot gases, cinders and corroding fumes in the smokebox increase and become magnified by indifference to the advantage to be derived from the invention, and it is quietly permitted to fall into innocuous desuetude. That is a summary of the history of nearly all expanding nozzles.

Nearly all locomotives burn more fuel than they ought to, and this is in a great measure due to the use of exhaust nozzles that are too small. There is a general tendency to make nozzles as large as possible; but they must not be made so great that the exhaust will not be sufficiently sharp to burn the worst kind of coal supplied. Perhaps once in a month a tender load of coal will be put on which requires a very sharp blast, and for this rare occasion the nozzles must be regulated to uselessly devour fuel the rest of the time. This is a very wasteful practice, but it pays a railroad to throw away fuel twenty-nine days rather than have an engine stalling for want of steam and disorganizing the train service on the thirtieth day. The economical remedy for this is to employ an exhaust nozzle that can be opened or closed to meet the requirements of draft. Exhaust nozzles that fulfil these conditions can easily be found, but it needs persistent attention to keep them in use. They will stand neglect and maintain their efficiency. That is why there are so few variable nozzles in service.

Designing, Building and Repairing Locomotives.

With few exceptions, every mechanic is a critic of some sort or other. Too many are of the destructive sort only, finding fault with everything in sight, but offer no suggestions as to improving it. A fewer number are always telling what they would do, and though it may sound egotistical and become tiresome, it is to be preferred to the first, as the suggestions are often of value.

If we go to the designer he is apt to show us a new engine which he enthusiastically describes, and we possibly enthuse over it with him. When it gets into the shop we talk with the men in charge of the work, and it is surprising if they do not criticise the design pretty severely in some details, owing to the difficulty of following the plans in the shop. It is one thing to draw a plan on paper and quite another to work it out of iron and steel in the shop at a moderate cost. If the designer had been a practical machinist he would not have planned in the same way, but would have considered all the details of shop work as well.

After the engine is on the road we go to the roundhouse foreman to inquire about it, and after telling what good work it is doing, he points out what he calls poor designing. Not that it affects the engine's work, but the cost of repairs is increased by parts being inaccessible, and this also tends to prevent proper inspection. The foreman thinks that if the designer and builder had only been repair men for a few years they would have changed all that, and then the engine would be a "hummer" in every way.

The men who handle the engines must not be forgotten either, for convenience in the cab and get-at-ableness of running parts are items for serious consideration. This was forcibly brought to mind recently by seeing an engine with the lubricator so placed that the fireman found it most convenient to get on the cab roof to fill it through the ventilator.

In order to have the required experience to see all sides of the question a man must have had exceptional opportunities. And even if he has been through all the departments, the methods have changed since then, making his experience out of date to some extent.

The practical solution of the difficulty seems to be a conference with all of the departments represented. Let the designer show his plans, the shop man tell how they can best be carried out while the repair men and enginemen show the parts that must be made accessible for inspection and repair.

The first two parties can get together in the shop which builds the engine, but the other men should come from the road on which it is to run, as they know the peculiarities of that road, as well as the facilities for repairing engines. This may seem to some like exalting the repair man above his proper plane, but those who know of the importance of keeping engines in service will readily see that it is worth considering.

Liquid Air as a Motive Power.

There has been so much of the quackery species of information put before the public about liquid air that there is a tendency in the engineering world to discredit its possibilities. In spite of many failures, compressed air as a motive power is making progress into favor, and we think that the companies advocating the use of compressed air for transportation purposes should give liquid air more consideration.

The question of liquid air power is succinctly presented by a writer in the *Forum*, who argues that it is virtually an initial compression of air to 10,000 pounds a square inch, which gives a great advantage as regards storage and transport; and then, as by expansion and heating it can be brought to precisely the same pressure and temperature as in the case of ordinary compressed air, it follows that, if there is an advantage in using the latter, it is obviously more advantageous to employ liquid air. Further, this writer asserts that, as the great increase of efficiency of steam engines during recent years has been owing to the employment of higher initial pressures, it is but the part of reason to admit that the discovery, by means of liquid air, of a way to attain vast initial air pressures, opens the door to higher efficiencies and greatly extended utilities in the use of air power. As is well known, of course, the common practice is to compress air to a pressure of, say, 2,000 pounds a square inch, for convenience of storage and transport, and then allow it to expand to a much lower pressure and to become heated in a hot-water apparatus before it enters the working cylinder.

Cast Steel in Locomotive Construction.

The introduction of cast steel in locomotive construction means more to the builder than appears on the surface. It is not merely the changing of foundry work, but of the method of working to some extent.

Taking wheel centers as an example, and we find that they are harder to turn, requiring more time to finish than the cast-iron center, and consequently costing more for labor.

In boring for both the axle and crank pin—both forced fits—a difference allowance is necessary for the same pressure. Some data on this subject show that one-third the allowance of cast iron required practically the same pressure to force it in. Others say that half the allowance of cast iron is right.

This brings up another point in regard to force fits which is sometimes overlooked—the surface of the hole and axle or pin. Cast steel turns and bores much like machine or bessemer steel, and does not crumble as does cast iron. It is also much less spongy, and yields less to pressure. Cast steel will usually have a very smooth hole for forcing into, which accounts for some of the difference in pressure required. On the other hand, the mass of metal around the hole is apt to be less with the steel wheel, tending to reduce the pressure required for the same allowance.

Still others advocate leaving nearly the same allowance as in cast iron and using a greater pressure. They argue that there is no danger of having the pin or axle too tight, and advise pressing to as near the elastic limit in steel as we do in cast iron. This allows a greater pressure than with cast iron, and yet be well within the elastic limit of the material.

The other important part of the locomotive in which cast steel is being used is the frame, and on this point there is more dispute as to its advisability than in the case of wheels.

The steel men cannot see why they should ever attempt to forge such a complicated thing as a frame when it can be cast so easily; but the shop man has a different side to the story.

The allowanee for planing varies between 3-16 and ¾ inch, with ½ inch as an average, which is about the same as with a forging. But the planing is a different story. The planer must be slowed down, or a lighter cut taken, as ordinary tools will not stand under the same speeds and feeds as on wrought iron. The same is true of slotting and drilling.

Some roads are not planing the whole length, but only in spots as required for the pads and connections, but the same can be done with forged frames if desired and the same amount of saving accomplished.

Considering the question of first cost and the present price of castings makes the steel frames the most expensive in most cases. The principal advantage is that the metal is stronger than wrought iron, while the possible defects in castings are probably offset by the welds of the former frame.

Taking all sides of the case, it is an interesting problem, and one that is being watched with considerable interest in many places.

Defective Switch Lights.

Talking about switch lights in LOCOMOTIVE ENGINEERING has brought about a discussion of their defective arrangement among the readers. One of the troubles complained of by engineers is having the light so placed on the top of the switch stand that it does not show in a straight line towards the approaching engine, but instead, the lamp is twisted around so it shows off to the side. This may be on account of the switch stand not being set exactly square with the track, or the top may be twisted out of the true direction, in which ease the best part of the light goes to one side of the track, and the engineer gets only a small part of the direct rays. Such defective lights should be relocated and set so that the light will, whenever possible, shine down the track squarely. It may be said that on a curve this cannot be done. We will grant this, but the angle at which the light leaves the bullseye or lens is wide enough to give a good indication of the position of the switch when the lamp is square. When the matter of having switch and order board lights exactly square with the track is not systematically looked after it will be found that the complaints of switch lights that are so dim that they cannot be seen except at close range and commendations of other lights because they show so clearly depend a good deal on the fact that some are not square with the tracks they govern and the good ones are set properly.

Change the lamps around from the dim ones to the bright ones, and if the same switch shows a dim signal always, have the lamp stand lined up.

Counterbalancing.

In looking over some old data, we find that the counterbalancing of locomotive driving wheels is credited to Thomas Rogers, founder of the Rogers Locomotive Works. His patent specification was filed July 12, 1837.

The importance of this was not recognized by others for some time, and even then many doubted the necessity of balancing anything more than the cranks.

The secretary of the American Railway Master Mechanics' Association has prepared an alphabetical index of subjects of reports, papers and discussions that run through the thirty annual reports that comprise the whole transactions of the association. The work was done at the request of a committee appointed last year to ascertain to what extent the recommendations of the American Railway Master Mechanics' Association were being put into practice, of which Mr. F. A. Delano is chairman. The work has been very well done, and will prove a very useful means of identifying the numerous subjects that have been reported on and discussed. Special attention has been directed to bringing to the eye the subjects on which recommendations for adoption have been made, and also the reports relating to standards. We would earnestly urge all master mechanics to go over these parts carefully, for we are certain that many of them will learn something about the standards of the association which they never heard about before.

The latest invention that is expected by the inventor to enable railroad trains to attain a speed of 150 miles an hour has originated in Belgium. It consists of two pairs of huge driving wheels placed in the front and end of a large car. The front of the engine is sloped from smokestack to rail, for the purpose of reducing the air resistance. We have seen combinations of this kind before, but they never stuck with any tenacity to the favor of railroad officials. Nothing seems too absurd or too great a failure when offered as an improvement on railroad rolling stock to stand forth as an example against repetition.

The demand for copies of the pamphlet on Mr. H. C. McCarty's paper on "Lubrication of Freight and Passenger Equipment Cars," read before the Central Railroad Club at its January meeting, has been so much greater than expected that a larger number has been printed than originally intended, and the secretary is prepared to furnish any number that may be ordered, the price being 12 cents per copy.

Feet Per Second, Etc.

One of our friends wanted a book giving the distance traveled in feet per second for different speeds per hour, so we made out the little table which follows. It gives speeds from 5 to 75 miles per hour in 5-mile units. This is also given for 1 mile an hour, so that any speed wanted can be found. If a speed of 39 miles is wanted, just add the figures for 35 and for 4 miles, which will give 114⅖ rail lengths per minute and 57 feet 2⅖ inches per second.

Miles per Hour.	Rail Lengths (30 foot rails) per Minute.	Feet per Seconds.
1	$2\frac{14}{15}$	1′ $5\frac{3}{5}$″
2	$5\frac{13}{15}$	2′ $11\frac{1}{5}$″
3	$8\frac{12}{15}$	4′ $4\frac{4}{5}$″
4	$11\frac{11}{15}$	5′ $10\frac{2}{5}$″
5	$14\frac{2}{3}$	7′ 4″
10	$29\frac{1}{3}$	14′ 8″
15	44	22′
20	$58\frac{2}{3}$	29′ 4″
25	$73\frac{1}{3}$	36′ 8″
30	88	44′
35	$102\frac{2}{3}$	51′ 4″
40	$117\frac{1}{3}$	58′ 8″
45	132	66′
50	$147\frac{2}{3}$	73′ 4″
55	$161\frac{1}{3}$	80′ 8″
60	176	88′
65	$191\frac{2}{3}$	95′ 4″
70	$205\frac{1}{3}$	102′ 8″
75	220	110′

The Public Utility Association of Bernese Oberland, Switzerland, with seat in Interlaken, has just published a gem of a little book of information for the Americans who anticipate a trip abroad next summer. The inquiries of such about the beauties of nature, the railroad and hotel accommodation of the country have been too numerous to be answered individually. The above mentioned association therefore will be glad to mail this richly illustrated book gratis to anyone sending address.

The Railway Times, of Bombay, India, evidently reads LOCOMOTIVE ENGINEERING pretty thoroughly. The latest clipping is "Breaking in New Engines," by Mr. Conger. They give credit, though; so they are welcome.

The new dining car service on the Lackawanna road is fast making friends. This is now run by the road itself, and is conducted on the "pay for what you get" plan, and the service is good.

We have only a few more of the old edition of Conger's Air-Brake Catechism. The new 1900 edition is enlarged and improved, and can be had for 75 cents and $1, according to binding.

Between the Ocean and the Lakes—The Story of Erie.

This book, which is by Edward Harold Mott, is written in a clear, lucid style and is very readable, although it deals largely with statistics. A thing about the work which must strike the reader familiar with railroad affairs is the immense amount of research involved in accumulating the vast volume of data required to tell the story as it has been told. The book has lain on our desk for several months, because we did not care to make looking through it the basis of a review, and reading it is a formidable undertaking, for it has 511 pages, 11½ x 9¼ inches, making a long story. The book is beautifully printed on thick, double-coated paper, and contains a great many handsome engravings, mostly portraits of men who have taken important places in making up the story of the Erie. John S. Collins, New York, is the publisher, and the book is sold for $7.

The romance of the railroad does not, as a rule, have anything to do with its conception, the raising the wherewithal to build it, the locating of the line, the construction of the road or in the finances of its operation; but the Erie has been a conspicuous exception, and all these have furnished material for a story that reads more like a romance than a narrative of real events. To be sure, the heavy villain is too much in evidence, and there are other personages, shading from the unscrupulous speculator to the pettifogging politician and the imbecile marplot, whose work exercised a most malign influence upon the railroad and upon the interests it was designed to promote. The evil, however, was mixed with considerable that was good, and between the two conflicting influences a great railroad was constructed which added a new artery of commerce when means of transportation between the Atlantic and the Lakes were painfully limited.

New York city has always been noted for the enterprise displayed by its public men in working up schemes for the benefit of its trade and commerce, and they have generally succeeded in placing upon the shoulders of people who were to derive no benefit from the schemes a heavy share of the burdens to be carried. The Erie Canal was made and improved by money largely drawn from the pockets of people who derived no benefit from the enterprise, and those who were the direct gainers appeared to miss no opportunity to oppose such public works as the Erie Railroad.

When the proposal to construct the canal was first submitted to the State Legislature the people of the southern tier of counties became much alarmed lest the proposed new waterway would take away the increasing travel between the Atlantic and the Lakes which was following routes in the valleys of the southern counties. The legislators from these counties were combining to oppose the canal scheme, when their opposition was bought off by a promise from the Governor, supported by the promoters of the canal, to have the State build what was called an Appian Way, or great road, from New York to the Lakes through the natural thoroughfares of Southern New York State.

By the time the canal was finished its friends had forgotten the favors received from the people of the southern counties. The year before the canal was opened Governor Clinton brought up the promise of building an avenue through the southern counties. The friends of the canal agreed to permit the State to make a survey of the proposed highway; but they dominated those in charge of the surveying party and made them run the line over a route that was impracticable and brought ridicule upon the scheme. This was the beginning of the active opposition of the Erie Canal ring to enterprises for improvements in land transportation. The opposition has never ceased. No means were, in the early days, too low and contemptible for these people to employ. Fraud and corruption and double dealing were their ordinary methods in opposing rival interests, and misrepresentations, false witness and perjury were weapons freely used in frightening railroad companies projected or in operation.

An Appian Way such as the Romans used was a perfectly sensible proposal to submit in 1817, but in the eight years that followed before the Erie Canal was finished the world had made unwonted progress concerning methods of land transport. All well informed people had learned something about tram ways or rail roads, and these were looked upon as worthy of trial. The Appian Way was in its most substantial form a rail way with smooth stone blocks made to carry the wheels of chariots or cars. This kind of rail way had an extended history before and after the Roman era. In some of the great centers of a civilization which flourished in Asia and Africa thousands of years before our present era, there are places where nothing remains as evidence of past industry but parallel granite blocks worn down with the friction of millions of wheels. The granite ways remain, while not a stone of the temples and palaces stands upon another. The modern imitators of the Roman Appian Way worked on an humble scale. They were found mostly in Germany, where the word "tram" comes from, and the people used stone blocks or wooden trams in connection with quarries, coal pits and other places where heavy material had to be moved. England borrowed the practice and the word tram from Germany, and from there it extended to the United States.

The building of a railroad through the State was an enterprise that promised to be much more useful than an Appian Way or macadamized highway, and such an artery of travel was entitled to the support promised to the highway, but the canal gang was sleepless in opposition. By degrees a movement took shape to build a railroad from New York to Lake Erie, no matter what opposition might be encountered.

The scheme began to take a practical form about the end of 1831, and there was then no reason to look upon it as visionary, for several railroads were in operation in America, some of them having locomotives. The Baltimore & Ohio was pushing construction so vigorously that 73 miles were in operation the following year; the Charleston & Hamburg had a locomotive in use for nearly two years; the Mohawk and Hudson Railroad had one locomotive at work and was about to receive a second one. An agitation in favor of railroad building was exciting the people, and nearly every Legislature in the country was flooded with applications for charters.

Early in 1832 a number of capitalists and influential gentlemen of New York and from places along the proposed route of the railroad secured from the Legislature a charter for the building of the road, in which the capital stock was placed at $10,000,000. It was agreed that the whole of that capital should be subscribed for and $500,000 paid in before the company should be organized. In spite of the big paper capital, the incorporators could not raise sufficient money to pay for a survey, so they applied to the United States Government to do the work. Part of a survey that proved useless was the result.

The next three years were devoted principally to the soliciting of donations of right of way and of subscriptions to aid the company. The directors and stockholders were nearly all connected with financial interests, and many of them were rich, but they did not intend to spend money on building the railroad if it could be begged or borrowed from others. They talked of giving up the charter when donations were coming in very slowly; but nothing was further from their intention. Their star of hope was the State Legislature, and that was worked with industry and skill. The last thing the promoters thought of was to draw upon their own resources to help forward the enterprise.

About three years after the charter was taken out a survey of the proposed location was made, and actual building was begun in the end of 1835. The charter originally specified that the road would have one terminus near New York, the other near Dunkirk. Before work was commenced an amendment to the charter was secured which permitted the company to make the Eastern terminus at Piermont, on the Hudson river. This change was made because one of the directors owned a big stretch of swamp land in the neighborhood of the proposed terminal. The same kind of influence was brought to bear on locating the Western terminus.

In carrying on the operations of building a railroad from New York, or even from Piermont, to a Western point, the proper procedure would naturally be to begin at tidewater, where material could be landed at the least possible expense, and work away from the base of supplies. That was not the way the promoters of the Erie did business. The president of the company asserted that the interests of the enterprise would be best served by beginning work at Deposit, 175 miles from the Hudson river, and there the beginning was made. Merely a beginning, however, for the actual construction began at Piermont.

About the time that they were ready to begin building an influential director, Eleazar Lord, had a motion passed by the board that the track gage should be 6 feet. His idea for recommending this wide gage was that it would prevent connecting lines from carrying away business that was intended for New York city. The chief engineer favored the wide gage for a different reason. He held that the gradients on the road would be so steep that locomotives could not be built to the 4 feet 8½ inch gage powerful enough to haul the trains.

This Mr. Lord, who was three times president of the company, was a man of ideas, and insisted on carrying them out, right or wrong. At one time he concluded that piles would make a better roadbed than grading, and he had piles driven for over 100 miles at an expense of about $1,000,000, and the track was never laid on them.

That was one of many expensive blunders made in the five years when the road was under construction; but the last spike was driven in 1851 amidst great rejoicings. The friends of the enterprise hoped that the financial misfortunes and troubles which had beset the period of construction were over; but in reality they were only well begun.

The greater part of the Story of the Erie relates to financial matters and descriptions of the machinations of Wall street speculators to obtain control of the property, and the disreputable methods they often employed to beat each other. Three years after the road was opened a code of rules for the government of the employés, drafted by D. C. McCallum, led to a strike of the engineers and firemen. After traffic had been suspended for ten days the company gave in.

About this time, Daniel Drew, who was for a time treasurer, begins to appear as taking an active part in the management of the company. He will readily be accorded the place of heavy villain of the story, and his conflicts with Commodore Vanderbilt and Jay Gould were struggles of giants. Neither of the combatants was scrupulous about the methods employed, but Drew seems always to have been contemptible, and the reader is relieved when the head of Daniel is finally crushed under the heel of Gould. Drew was, as far as we can learn, the first railroad director to combine with Wall street brokers to depreciate the stock of the company he was supposed to serve.

During 1856 and 1857 affairs of the Erie were drifting rapidly to disaster. The road was suffering from loss of traffic. due to New York Central competition. There had been bad crops and a severe winter, which nearly gave the finishing blow to the worn out track and dilapidated locomotives. Then there was a second engineers' strike from the same cause as that which happened two years before, and this one cost the company $500,000.

The efforts of the management for the next eighteen months were devoted principally to the borrowing of money to meet current expenses.. Then the struggle was given up as hopeless, and the company went into the hands of a receiver. The president, Nathaniel Marsh, was made receiver. He held the office two years, and effected material improvements on the property, among them the piercing of the Bergen tunnel and the constructing of Long Dock on the Hudson river, opposite New York. He also carried out much needed betterment on track and rolling stock.

The company was reorganized in 1861. As far as we can make out from repeated reading of the story, the company began to fall into financial difficulties very shortly after the receiver was discharged, and they went from bad to worse until a receiver was again appointed, in 1875. There had been a receiver appointed several times in 1868, but it was in connection with the Drew-Vanderbilt-Gould war, and was merely part of financial strategy.

Shortly after the reorganization in 1861, Drew, Vanderbilt, Gould and other Wall street speculators began playing against each other, with Erie as the football. The property was for years used almost exclusively for stock jobbing purposes, and care and maintenance of the material part of the road was the last thing thought of. The presidents were nearly all financiers, and many of them looked upon the railroad merely as a basis for stock manipulation. During the brief control of Jay Gould a vigorous start was made to put the property in first-class condition, but his reign was too short-lived to do much good. Gould worked out a magnificent scheme of extensions that would have made the Erie the eastern end of a transcontinental system, and his first repulse came from the Legislature of Pennsylvania at the request of the Pennsylvania Central Railroad Company.

Shortly after that Gould was thrown out of Erie and the company dropped back into old ways, drifting along towards bankruptcy, chronically short of money, harassed with debts, and the officials in control doing their best to hide from the public the true state of affairs. In 1874 Hugh J. Jewett was elected president, and a new policy was inaugurated—that of telling the truth about the affairs of the company. Mr. Jewett was an able business man, and proceeded to manage the property on business principles. He astonished people by intimating that the proper thing to do with the Erie Railroad was to make it earn profits by carrying passengers and freight, from which debts and dividends should be paid. Before he retired Mr. Jewett was most cordially hated by the stock gamblers who had fattened for years on Erie's misfortunes.

The sound business management of Jewett came too late to save Erie from catastrophe. Speaking of the condition of the property when he took charge, Mr. Jewett said: "The rolling stock was insufficient and defective, because of neglect in replacement and repairs by former managements; a railroad almost entirely made of iron rails, upon a roadway largely of single track; locomotives and cars of a variagated sort as to pattern, size and date of build, there being no less than eighty-five different patterns in use. . . . The roadway in deplorable condition, out of repair and deficient in ballasting, cross ties decaying, sidings and yards insufficient, and things generally down at heel."

Shortly afterwards Mr. Jewett was appointed receiver, and in April, 1878, the property was sold at public auction, a victim of gross mismanagement and robbery.

Mr. Jewett was made president of the new company, which was called the New York, Lake Erie & Western, and he remained in the position till 1884. Jewett's administration was not of a flourishing character, but the revenues were used honestly, and were, as far as possible, devoted to putting the property on a modern basis. The road was laid with steel rails, double tracking was completed between New York and Buffalo, the gage was reduced to the standard and the rolling stock was put in first-class condition, and many other important improvements were carried out.

In 1884 John King was elected president, and he took charge, proclaiming that his policy would be retrenchment and reform. Mr. King had not been in control a year when the floating debt of the company began to be troublesome. In his first annual report President King had to report that the earnings had fallen nearly a million and a half short of expenses. Things improved for a year or two, and in 1890 some dividends were paid, but the floating debt, coupled with low rates and decreased earnings, were pushing the company again towards bankruptcy, and in 1893 the directors put the property into the hands of receivers, John King and John G. McCullough being selected. There were none of the old-time sensations connected with this receivership. It was merely a case of the earnings being inadequate to meet the expenses.

After several plans for the reorganization of the company had been discussed, the property was sold under foreclosure in November, 1895. Mr. E. B. Thomas was elected president of the Erie Railroad Company, as it is now called. He did not proclaim what his policy would be, but he went to work absorbing the properties that are natural feeders of the Erie, and the affairs of the company seem to be going along as smoothly as those of other great railroads. By this reorganization the company has got rid of the floating debt specter, and the earnings are more than sufficient to meet the fixed charges. "Happy," they say, "is the country which has no history." The same may be said of corporations. The prospects are that the Erie will have no more history worth writing about.

Cooke Consolidation for Oregon Short Line.

This is a modern heavy-weight consolidation in every particular, and while it isn't a record-breaker, it can exert a drawbar pull of 43,000 pounds, while the ratio of adhesion is a trifle over 4. The main dimensions are:

Cylinders—21 x 32 inches.

Weight on drivers—174,000 pounds.

Weight on trucks—22,000 pounds.

Total weight—196,000 pounds.

Driving wheel-base—15 feet 2 inches.

Total wheel-base of engine—23 feet 5 inches.

Driving wheels—55 inches diameter.

Engine truck wheel—30 inches diameter.

Driving axle journals, diameter—9 x 12 inches.

Engine truck axle journals—6 x 9 15-16 inches.

Boiler, type—Straight top, crown bar.

Boiler, working pressure—200 pounds.

Boiler, diameter first course—78 inches; thickness of shell, 13-16 inch.

Boiler firebox—Length, 123 inches; width, 39½ inches.

Boiler tubes—Number, 385; diameter, 2 inches; length, 14 feet.

Boiler, heating surface tubes—2,755 feet; firebox, 218 feet; total, 2,973 feet; grate surface, 33 square feet.

Richardson-Allen valve—Travel, 5⅞ inches.

Lap of valve—1-16 inch inside, 1 5-16 inches outside.

Center of boiler from rail—8 feet 9 3-16 inches.

Top of stack from rail—15 feet 6 inches.

Tender frame—10-inch channel steel.

Truck, style—Fox pressed steel.

Tank—Water capacity, 5,000 gallons; coal capacity, 10 tons.

The equipment is: Nathan lubricators, Ashcroft steam gages, Cooke Locomotive & Machine Company whistles, Leach sanders, Jerome piston packing, New York air brakes.

COOKE CONSOLIDATION FOR OREGON SHORT LINE. (DETAILS ON NEXT PAGE.)

Didn't Know What Hooking an Engine Up Meant.

About two years ago we stepped pretty heavily on the pet corns of one of the now defunct correspondence schools. The proprietors were good business men and supposed they were getting the best talent, but their instructor in locomotive and air-brake practice was not burdened with practical knowledge on either subject.

He had great confidence, however, and after we had criticised his answers to certain questions he marched into the office one morning with fight in his eye. He at once proceeded to tell what he didn't know about locomotives in such an unmistakable manner that we knew him immediately.

He finally began talking valve gears and the action of the link. Then we said something about "hooking up" to shorten travel, and he thought we were poking fun at him.

"I was talking about an engine running light," he said, "not coupled on to a train. Why can't you stick to the subject?"

"My friend, what do you think 'hooking up' means?"

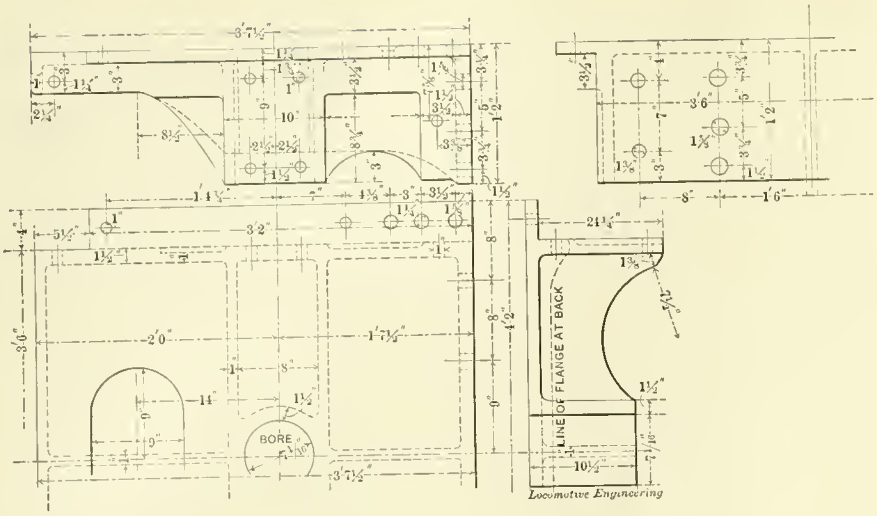
" 'Hooking up,' " and a fine look of 7 by 9 scorn spread over his classic features, "why, 'hooking up' is *coupling on to a train*—any fool knows that."

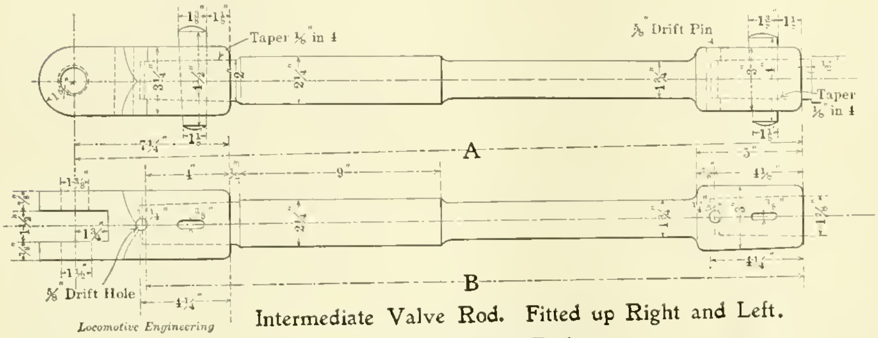
"They don't all seem to, Mr. Professor Know-it-all. That remark alone shows you are not familiar with locomotives or with locomotive men, and I have my doubts if you ever *saw* one, except at a distance. Ask the greenest brakeman on the poorest road in the most God-forsaken part of the country, and he'll tell you what 'hooking up' means—to a railroad man. And it might be a good scheme to get him to answer your questions for you—he couldn't do any worse than you, and he might do better." Then he left us.

Chicago, St. Paul, Minneapolis & Omaha Shops.

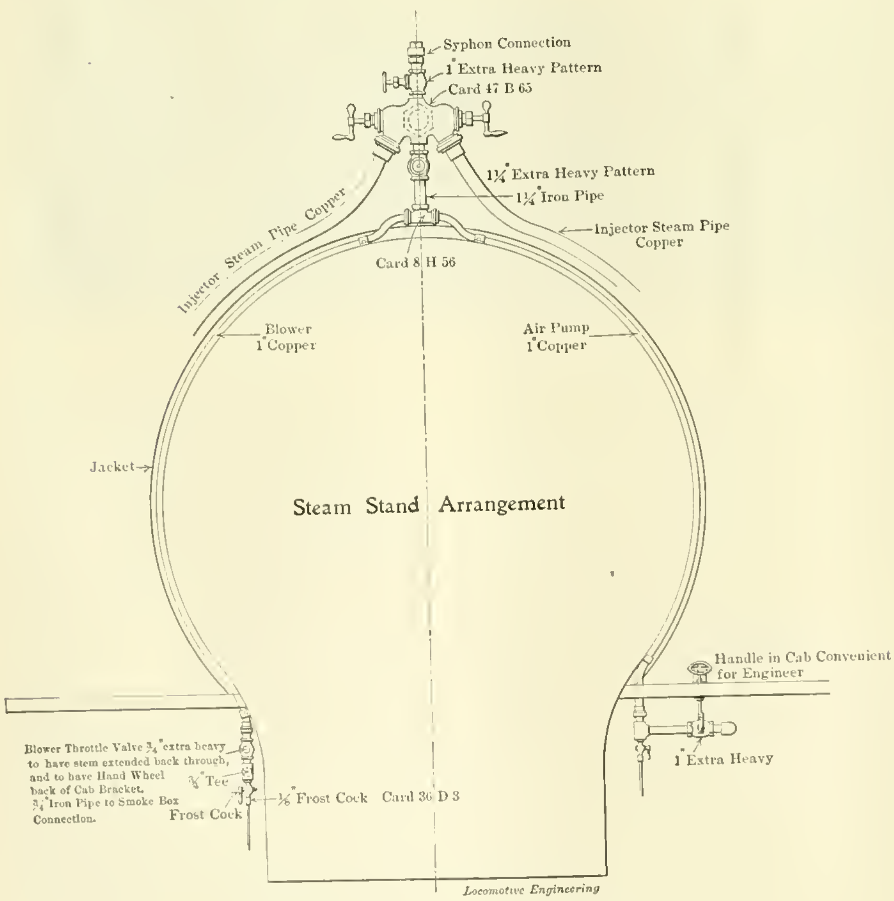
The shops of the Chicago, St. Paul, Minneapolis & Omaha Railway at St. Paul are about as neat, tidy and busy as any to be found. Mr. J. J. Ellis, superintendent of motive power and machinery, believes that neatness makes good workmanship. He has just installed three new Hiene safety boilers and cut down the fuel bill for December over $200. The heating of the buildings is done by steam; all the condensed water is trapped back to a central tank under ground. That from the engines passes through a grease extractor, and this condensed water returns to the boilers as feed water.

An elevated track brings the coal from the gondolas outside around into the fireroom in buckets, where it is dropped on the pile with as little fuss as possible, doing away with dust and breaking up the coal from too much handling. The compressors and electric lighting plant are all located in the engine room. Four hundred and fifty incandescent and twenty arc





Intermediate Valve Rod. Fitted up Right and Left. Right Rod.



SOME DETAILS OF COOKE CONSOLIDATION.

lights are used in lighting up the shops and engine house, besides an electric transfer table. The big drop pit, which will take all the wheels out from under an engine at once, is still in active service. In addition to this one in the erecting shop, there is one for drivers and one for truck wheels in the roundhouse.

The old offices at the end of the machine shop are now used for motion work and rod work; one of the rooms is for injectors and lubricators. The new office building is on the hill overlooking the shops.

Oil-burning furnaces are used for spring work and for welding flues. Flues are all rolled with an air motor. When working at the firebox end, the motor sets on the engine deck, and the shaft goes through the firebox door at the front end; the motor sets on the pilot beam. Three of these motors are in service. Pneumatic tools are used wherever they will expedite the work. An Ingersoll-Sergeant compressor, handling 500 cubic feet of free air per minute, keeps the tools running.

At the cinder pit, which is a deep one, ash buckets are used, which roll under the track into the pit. When filled with ashes, they are rolled out, an air hoist hooked on and the ashes dumped into a gondola.

In the line of new machinery, he has just put in a set of boiler-plate rolls, which will bend a sheet 3 inches thick by 12 feet wide. This machine is from the Niles Tool Works. A new Bement slotting machine is at work. Four new Schenectady passenger engines are in service; they are 19 x 24-inch cylinders; driving wheels, 73 inches outside tires; equipped with electric headlights and all the modern improvements.

Mr. Ellis has an additional oil pipe from the cab to the steam chest—besides the one from the lubricator—on some of the engines. This additional oil pipe has a hand-oiler attachment in the cab.

Steel eccentric straps, bushed with brass, are used on the fast passenger engines. Water pipes to cool off crank-pins in emergencies are on a few of the engines; none are allowed on driving boxes.

Mr. Ellis is about to build a new air-brake instruction room with all the latest improvements in the way of sectional valves, blackboards, charts, etc. They have just received a new Bay City Industrial Works wrecking derrick, which weighs 75 tons and will lift 40 tons.

Making Certain.

A few years ago the native station master of an out-of-the-way Indian railway station was suddenly attacked by a tiger, made bold through hunger. The startled assistant immediately rushed to the telegraph office and wired to the European station master at the next place on the line as follows: "Tiger on the platform eating station master; please wire instructions."—*Short Stories.*

Blacksmith Tools in a Small Railroad Shop.

A visit to the Springfield (Mass.) shops of the Boston & Maine Railroad on a cold and gloomy morning, when it was necessary to pick one's way gingerly over icy sidewalks, was well repaid by the cordial welcome of Master Mechanic Aiken and the rest. This is a division point on what was formerly the Connecticut River road, and the shop has not been equipped with all of the tools it might have used to advantage. It is in such places as these, however, that we find ingenious kinks and ways of doing work, and this was no exception to the rule. In this case the blacksmith shop seemed to be the center of attraction in this respect, although the machine shop was doing its best with the tools in hand. One thing here was a tool for cleaning the scale off tubes. It was a series of rollers on a frame that was held in the tool-post and fed along the pipe, cracking the scale as it passed over the tube. But to the blacksmith and his tools.

Mr. Aiken turned me loose with his foreman blacksmith, Mr. E. P. Fitzgerald, and a genial companion as well as instructor I found him. He is enthusiastic and, as we shall see, ingenious—a combination which always produces results.

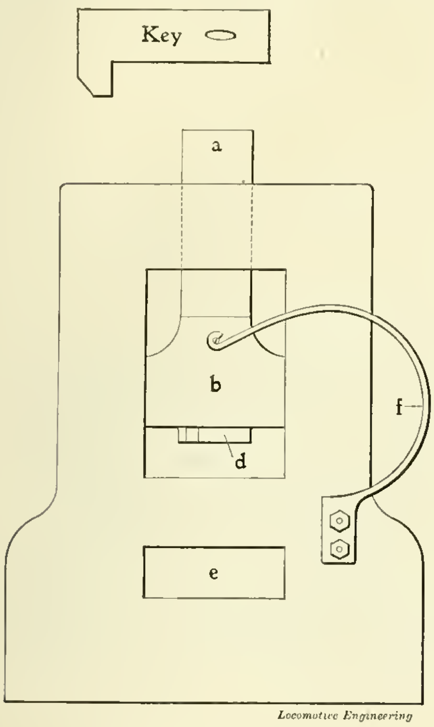
His tool equipment is limited, a steam hammer being the most noticeable of all, and this he uses in every way possible. Having no cutting-off machine or shears, he made one as shown in the sketch, which has a capacity up to 2⅜ inches round and 5 inches wide by 1 inch thick.

It consists of two cast-iron blocks, which together measure about 14 inches wide, 12 inches high and 8 inches thick. The opening is about as shown, and it will be seen that the lower knife *e* is clamped solidly between the blocks, while the moving knife *K K* slides in a groove placed into one of them. The springs *S S* support the knife by means of the rod shown, and return it after the stroke. The lower knife does not extend clear to the bottom, as it has been found better not to do so. This is placed under the steam hammer, and does very good work. The hammer has its head on an angle, so that any length stock passes through.

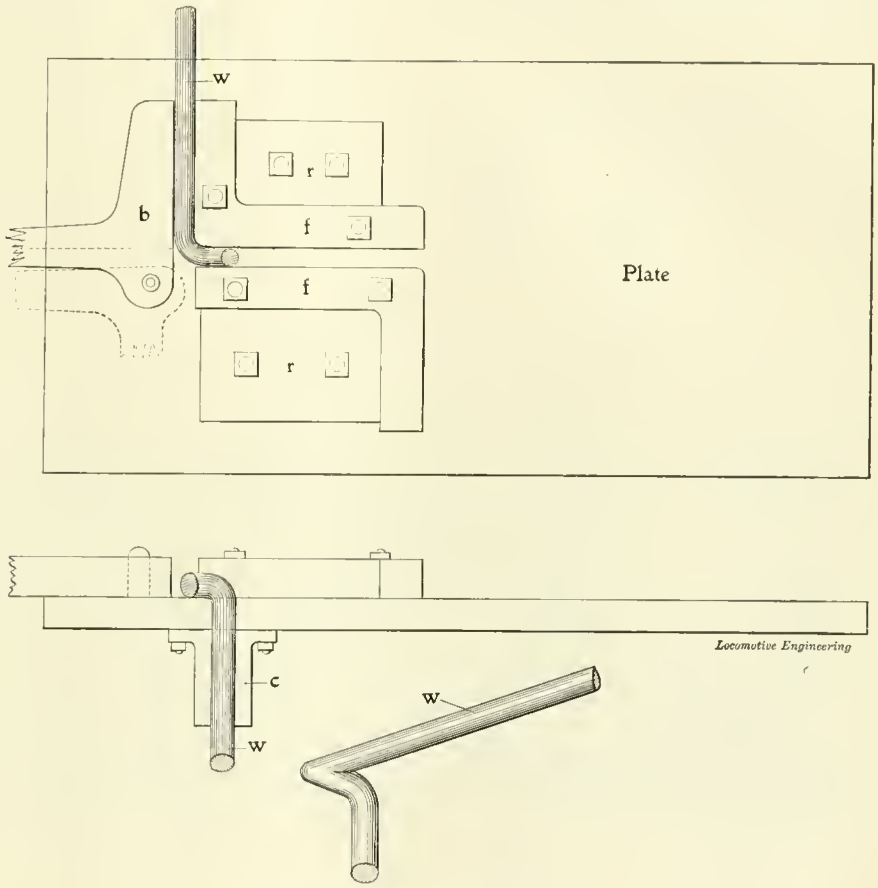
Much of the blacksmith work for the division seemed to be done here, the draw-bar being an example of this. Cast-iron dies are used, and they are about as simple as they can be made. Sketches *a* and *b* give a section and end view. The piece is worked down till the hammer reaches the top of the block, which gages its thickness. Sketches *c* and *d* show the scheme for punching the hole in end. The end is slipped into the die, and the hammer forces a steel punch through at the proper place.

There was also a special rig for punching draw-bar keys. These are about as shown in sketch and are 5-16 inch thick. This is also worked under the hammer, and the die *d* is fastened in the bottom of the ram *b*. The spring *f* returns die after stroke. Finished keys drop through and come out at *e*. With this they have punched 1,600 of these in eight hours from hot stock.

The link-pin lifter, such as is found on freight cars equipped with "side couplers" is one of the meanest things to bend and right that comes along, but Mr. Fitzgerald patched up a cheap rig which seems to do the work nicely. It consists mainly of a cast-iron plate with angle pieces *f f* bolted thereon as shown. These are reinforced by the plates *r r*. Stops on the end of the plate regulate the location ot the first bend. The second is not so easy.



PUNCH FOR DRAW-BAR KEYS.



BENDING LINK PIN LIFTERS.

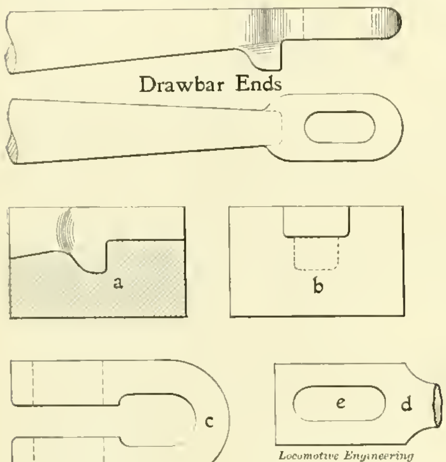
In the side view the end of the first bend *w* is seen stuck through the casting *c*, and the rest of the rod runs straight up, as shown by dotted lines in the first view. Then swinging the lever *b* around, bends the rod at the right place and in the right position. Of course, the rod is heated to do this, as it is quite heavy.

Spring blocks are another of the mean little things to handle, and he does this in a very neat way. They are about ½ inch thick and 4 inches wide. They are first cut off like *a* in the sketch. They are then put in the die at *c*, and held on end by a wedge against *d*. This leaves the bevel projecting above the die. A blow or two of the hammer turns the end over like *b*, leaving it of uniform thickness and a square corner. The artist has not shown the recess at *c c* as he should, but it can be readily understood that this is of the desired depth to gage the thickness.

Besides the dies shown he has many others, one very ingenious one being for forging engineers' hammers. He takes a 1⅜-inch steel bar, square, and only heats it once to make a hammer of it. All the dies are in a cast-iron block, and include punches for both starting and finishing the eye as well as flatting the corners and finishing the pene. They are not a particularly pretty lot of tools from the esthetic standpoint, but as they do the work required, and do it better and cheaper than before, the practical object is accomplished. C.

War on the Pan Handle Road.

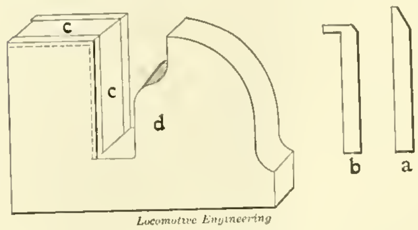
A lively fight took place between a coal-train crew and a main-line crew, at McDonald's Station on the Pan Handle road (Pittsburgh, Cincinnati, Chicago & St. Louis Railway), one day during the recent cold spell.



DIES FOR DRAW-BAR ENDS.

The coal-train crew, which conceived and fostered a policy of expansion, extended its domain and absorbed to its use both the adjacent east and west-bound main tracks. A flagman was accordingly sentineled to challenge approaching main-line trains and acquaint them of the newly adopted expansion policy of the coal-train crew. In less than a half-hour, three sections of fast freight "49" were stopped by the sentinel and held outside the sentry lines. Growing impatient and indignant at this seeming permanent absorption of the right of way, the main-line crews decided to throw out a line of scouts, and accordingly dispatched two brakemen to make a reconnoisance. Being unacquainted with modern warfare, the reconnoitering party neglected the use of a truce flag, and upon inquiring of the coal-train crew whether their absorption of both main-line tracks was permanent or only temporary, the scouts were set upon and told to "Get t'ell out o' here." Their retreat was hastened by sundry missiles of coal projected uncomfortably close to their heads by the coal-train crew.

The scouts returned to camp and reported that the coal-train crew was in a state of belligerency; whereupon a council of war was held by the three "49" crews, drastic resolutions adopted and war declared. The engineers filled their engines with water, and the three crews quickly mobilized their entire force, with the exception of the third section flagman, and marched forth on a war of civilization or extermination. Advancing, they found the coal-train crew strongly intrenched in a laager behind some Frick box cars, from which the belligerents were dislodged by a fusilade of ballast and coal stones. The retreat was orderly and was made across a veldt of tracks under a withering fire to a kopje behind the coal tipple. From here the belligerents rained a shower of lump coal on the enemy. The marksmanship of the belligerents was deadly. Their one-pounders and rapid firers created great havoc in the enemy's ranks; and the ambulance corps was soon obliged to conduct to the rear the fireman of first "49" and middle brakeman of the second section, with a goose-egg bump on the head and a cramp in the stomach, respectively.

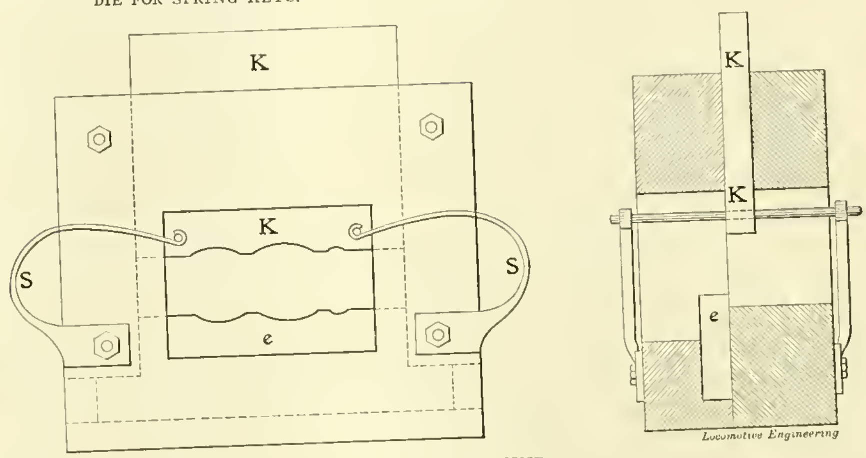


DIE FOR SPRING KEYS.

Failing to carry the coal-train crew's laager by a forward assault, the main-line fellows retreated in good order, and, with the characteristic mobility of railroad men in a fight, divided their force into two flying columns, which were thrown simultaneously on the right and left wings of the belligerents. The terrible enfilading fire of coal stones was more than the besieged coal-train crew could stand. They deserted their laager on the kopje back of the tipple, and retreated, panic-stricken and in disorder, across the veldt into a Rend box car, where they shut themselves in.

Peace negotiations were now begun by the besieged coal-train crew, occasionally interrupted by a hail of stones against the box car from the outside. Unconditional surrender and prompt vacating of the west-bound tracks were demanded by the victorious "49"-ers. This was agreed upon, war declared ended and peace again established. Great joy rested with the main-line crews, who felt that they had accomplished a noble work of civilization.

Fearing dire results should news of the fight reach the ears of the superintendent, the fighters imposed a severe censorship on the telegraph operator, and all news was suppressed. The delay to "49" was reported, "Grate bar burned out on Engine 86." The cause of the coal-train's late arrival in Pittsburgh was duly entered, "More work than usual," which was true.



CUTTING-OFF MACHINE.

A wonderfully interesting address was delivered at the December meeting of the New England Railroad Club by Hon. George G. Crocker, chairman of the Massachusetts Board of Railroad Commissioners, on the "History of the Development of Transportation." He began with the time when the people in New England as a rule traveled on foot and carried their packs on their backs—the well-to-do rode on horseback, the man's saddle often being provided with a pillion on which a woman could ride. Step by step he followed the development up to the palace car. The address is not one of which a synopsis can be made. To be enjoyed it must be read in full. It is too long for our space, or we would gladly publish it. We advise everyone who can procure a copy of the December proceedings of the club to get it and read that address.

When you see the front end of an engine enveloped in steam, there is usually something wrong with the rod packing. This is too often because it isn't kept up as it should be, and such exhibitions are of no credit to either maker or user. Everything deserves a fair show, and then if it fails, it is no fault of yours.

Boston & Albany Heavy Express Locomotive.

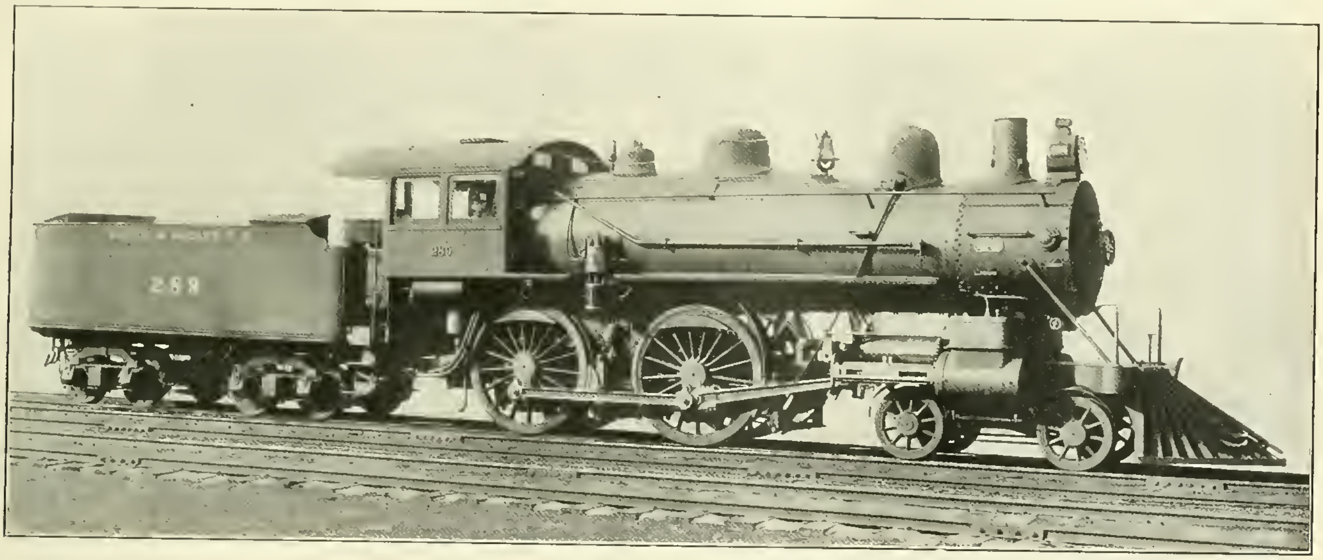
The eight-wheel express passenger engine herewith illustrated is one of six which have recently been built by the Schenectady Locomotive Works for the Boston & Albany Railroad. The engines are intended for the fast passenger service between Springfield and Boston, which requires working of trains on heavy grades. The engines are notable for their very liberal heating surface, which will help them in the heavy work to be done—in fact, they have the greatest amount of heating surface of any eight-wheel engines we are aware of.

The engine weighs 136,400 pounds in working order, of which 88,500 are on the driving wheels. The wheel-base is 24 feet 8½ inches, of which 8 feet 6 inches are rigid wheel-base. The cylinders are 20 x 26 inches; the driving wheels 75 inches diameter. The working pressure is 190 pounds to the square inch. This gives the engine a little more than 22,000 pounds tractive power, and the ratio of traction to adhesion is about 4. The ports are 18 inches long; the steam ports are 1⅝ inches wide, and the exhaust port 3 inches wide. The bridges are 1⅜ inches wide. The valves are Allen-Richardson, with 1⅛-inch outside lap and maximum travel of 6 inches. The valve setting is so arranged that the engines have ¼-inch lead when cutting off at 6 inches. The wheels are of cast steel and are held by shrinkage and retaining rings.

The bearing surfaces are notably liberal, the driving axle journals being 9 x 11½ inches. The main crank pin journals are 6 x 6 inches, and the side rods forward and back 4½ x 4 inches. The engine truck journals are 6 x 12 inches.

The boiler, as will be seen by the engraving, is of the extended wagon type, 64 inches diameter in front. The firebox is 108⅛ inches long and 40⅜ inches wide; depth varying from 79¾ to 66¼ inches. There are 344 2-inch tubes, 13 feet long. The total heating surface is 2,505.27 square feet, and there are 30.33 square feet of grate area.

Among the equipment are one twin Hancock inspirator, American brake on drivers, Westinghouse automatic air brake on tender, with 9½-inch pump, Leach sand feeding apparatus, Star brass chime whistle, Detroit lubricator with tippet attachment.



SCHENECTADY BOSTON & ALBANY EXPRESS ENGINE.

Starting a Railroad.

One of the most interesting little stories we have heard lately was the way in which what is now the Arkansas Midland was started. It was then called Arkansas Central, and ran from Helena to Clarendon, on White River. Mr. Albert H. Johnson, then of Oberlin, Ohio, was the man, and his success shows his determination and stick-to-it-iveness.

This was in 1873, and he was practically without funds, but he went energetically to work and got the road going.

It is said that he practically ran the train at first, being fireman, conductor, and a few other things all in one. As there were no other trains to look out for or passing points to make, he was able to do this as long as necessary. This kind of railroading is, of course, out of the question today, but a man who could do this would find a way out under any circumstances. It is with regret that we have to mention his death by accident on the Denver & Rio Grande Railroad, near Salida, Colo., early in December.

Mixed Scrap.

Have any of our readers had any experience in making forgings from scrap in which case-hardened articles, like old crank pins, links, link bushings, nuts and bolts from the motion work, are used? If so, does it affect the nature of the finished forging?

It is commonly supposed that the outside of a piece of case-hardened iron is changed into steel to a greater or less depth, according to the length of time the process of cementation has been carried on, and the question comes up, Does this scrap retain the nature of steel when worked into a forging? And does it make the forging any stronger than if it was all clear wrought iron?

First Aid to the Injured.

Under the head of "First Aid to the Injured," Dr. C. S. Parkhill gives in the *Trainmen's Journal* some interesting facts of this work on the Erie road.

They have adopted the plan of selecting an intelligent man at each point, instructing him as much as possible and giving him authority to take charge of the case until the surgeon arrives. He is provided with all necessary appliances for simple work, and generally gives very efficient service. There is said to be less fright on the part of the patient, who instinctively has more confidence in a man with even a little training, than in anyone who happens to be nearest him, and the results are gratifying.

It is very enterprising on the part of the secretaries of the various railroad clubs to secure sufficient advertising to cover the expense of printing the monthly reports, but really they ought to reserve sufficient space on the front cover to let readers know what the subjects are that are discussed inside. The front cover of some of the reports are worse than a Brooklyn elevated railroad station, where advertisements defy people to find the name of the station.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Achievements of the Air-Brake Association.

Seven years ago a handful of air-brake men organized the Air-Brake Association and held the first convention in Columbus, Ohio. The growth of this organization has been marvelous, and the work done instruction of men in instruction cars and plants has made hundreds of men familiar with the construction and operation of the air brake, where before only a few knew anything about it. In short, the aim of the Air-Brake Association has always been "To obtain a higher efficiency in air- were necessary in order to approach an ideal air-brake service. It has discovered and pursued these matters, pounding away diligently, sometimes well supported by higher railway officials, sometimes indifferently and sometimes even badly; but the visible success which it has achieved

AIR BRAKE ASSOCIATION OFFICERS FOR 1900.

1. President, W. F. Brodnax. 2. First Vice, R. H. Blackall. 3. Second Vice, T. H. Hedendahl. 4. Third Vice, P. M. Kilroy. 5. Treasurer, Otto Best. 6. Secretary, F. M. Nellis. 7. Assistant Secretary, F. W. Gross.

by the energetic young body has been phenomenal.

To-day the Association has an enrollment of nearly 500 members. There are now ten terminal testing plants for air-braked trains where there was but one seven years ago, and facilities for repair work have been largely increased. The brake service"—to reclaim and get into operation the many air brakes which the neglect and indifference of rapid equipment have permitted to fall into disuse.

This Association has seen that a better condition of car and engine brakes, operative parts on the locomotive and a more general understanding of train braking marks this young and vigorous association as one of the most important and best contributors of railway organizations.

There is one achievement of the Air-Brake Association, however, which has never been credited to it by eulogistic writers; and that is the harmony and accord which have been created among air-brake men by a closer association and wider acquaintance with their fellows. The arrogance and narrowness due to life in a limited sphere (and from which even air-brake men cannot claim to be exempt) have given way to broader ideas and to better and more liberal judgment. In a business sense, the Air-Brake Association has made men of boys.

There was a time, indeed, when two air-brake men met that it was "Draw your sword and measure it with mine, sir." It was a case of prove your superiority. At the first convention, even, several blatant fellows undertook by loud tone and dogmatic assertion to establish doctrines of which they have since been made to feel heartily ashamed, now that they know better and have improved by association and acquaintance. To-day, when air-brake men meet, there is a sensible and quiet interchange of methods and experiences—a total absence of the "Tear 'em up, Towser," spirit of old. Indeed, the man who essays to exploit himself as a "know-all" in air-brake matters nowadays is speedily reduced to a cheap thing. This—and a great deal it is—the Air-Brake Association has achieved.

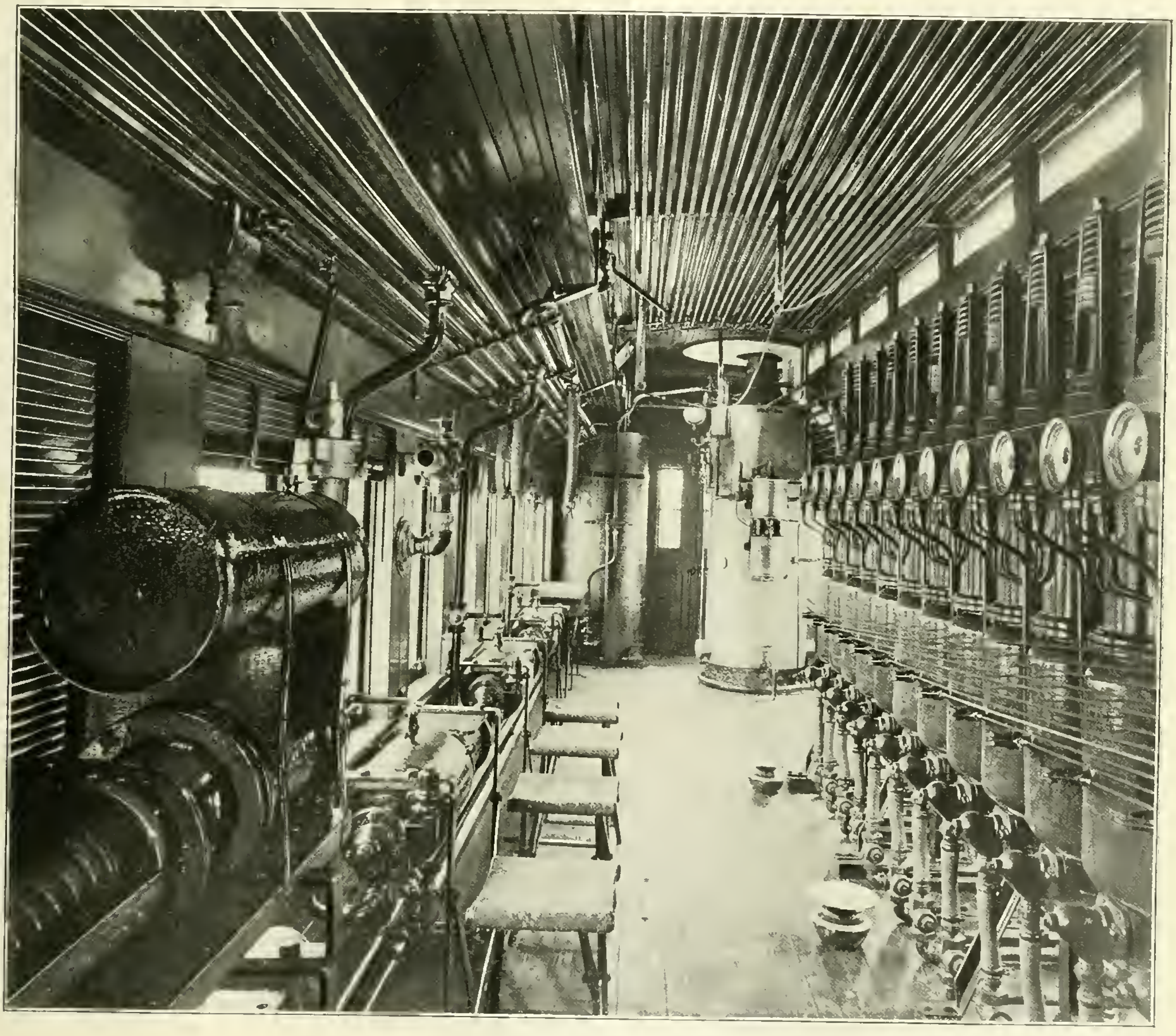
Pittsburgh & Western Instruction Car.

The Pittsburgh & Western air-brake instruction car, which we illustrate herewith, has been in service some few months and stands in the first class of instruction cars, a fitting testimonial to its builders, Master Mechanic Hyndman and Master Car Builder Anderson. Much, if not a greater part, of the designing of the car was done by Instructor M. S. Thompson, who has charge of the car and the instruction of the men. Traveling Fireman Schriver is an able assistant.

While the car has much in common with other well-arranged cars, it has several new and original features worthy of special mention. A dummy boiler, or, rather, the rear 8 feet of a boiler, constructed of wood, has mounted on it, in proper location, sectional models of injectors, lubricators and other cab and boiler-head fixtures usually found on a locomotive. Thus these parts are handily and strikingly grouped for instruction. The wooden boiler holds the main reservoirs and serves as a storehouse, *via* the fire door, for the many loose things in an instruction car.

The sectioned air pump on the side of this dummy boiler is ingeniously arranged to operate, all its parts moving as though in service, and the working of all its pistons and valves can be observed, the same as the sectioned triple valve working tandem with a live triple. Movement of the parts, however, is given by a 2-inch pipe cylinder whose stroke is the same as that of the pump. Air pressure is used.

Another new feature is a quick-action triple valve which has a part of the side of the valve cut away under the slide-valve seat; also the chamber above the emergency valve and under the emergency piston. Thus the pressure which ordinarily passes from the auxiliary reservoir to the brake cylinder in service application and from the train pipe in emergency, instead of going to the cylinder, passes to



AN INTERIOR VIEW OF THE PITTSBURGH & WESTERN INSTRUCTION CAR.

the atmosphere instead, thereby producing a sound which illustrates effectively the difference in an emergency application and a graduated application of the brake.

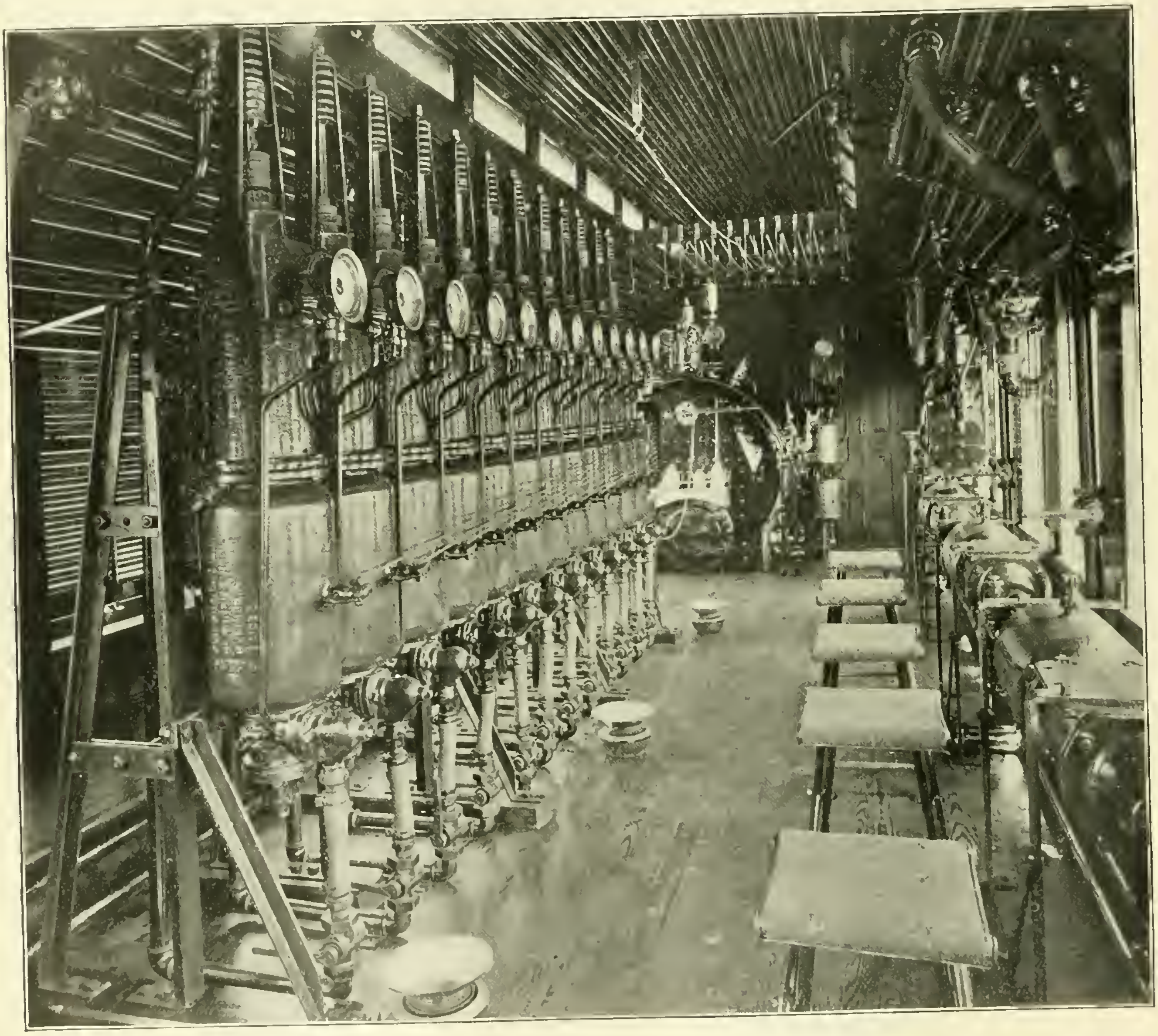
The car has been newly built from the ground up and has already proved itself a paying investment.

A Better Brake Needed.

Up to the present time, brakes on street cars, when at all considered, have been looked upon mainly from a life-saving point of view, with a minor consideration of the safety of rolling stock. A recent occurrence, however, promises to add another phase to the question and may cause a rush of street railways in some sections of the country to equip with high-speed brakes of some sort to better protect their cars from a threatened danger heretofore unseen.

The electric lines of the city of Nashville, Tenn., contemplate the equipment of all their street cars with high-speed brakes in the near future. So we are informed by Mr. Otto Best, superintendent of air brakes, Nashville, Chattanooga & St. Louis Railway, who gives as the reason a recent occurrence, as follows: A Main street car was bowling along at a pretty lively speed, when the motorman observed a burly negro standing in the middle of a block, near the track, apparently intending to cross over to the other side of the street after the car had passed. When the car was but a few feet off, and the gong clanging furiously, the negro suddenly took a notion to cross, and was scooped up on the fender and brought in violent contact with the front end of the swiftly moving car. Onlookers expected to see the brains of the negro dashed out. But they didn't dash. Things went the other way. His head came in contact with the reflector, which it smashed, and then the dashboard was bent back against the body of the car, firmly pinning fast and imprisoning the motorman, who was frantically twisting away at the handbrake, trying to stop the car.

The motorman, when released from a tangle of dashboard, hand-brake and controller, was found to be painfully bruised and cut about the legs. The controlling mechanism on the front of the car was practically ruined. The car was all but wrecked; but the negro, while a bit dazed, recovered quickly and came out of the scrimmage with only a scratched arm. He edged off, muttering something about "didn't mean no harm," and finally cut and ran down an alley lest he be fined or arrested for having wrecked the car. The car was shoved back to the barn to be repaired. So says Mr. Best.

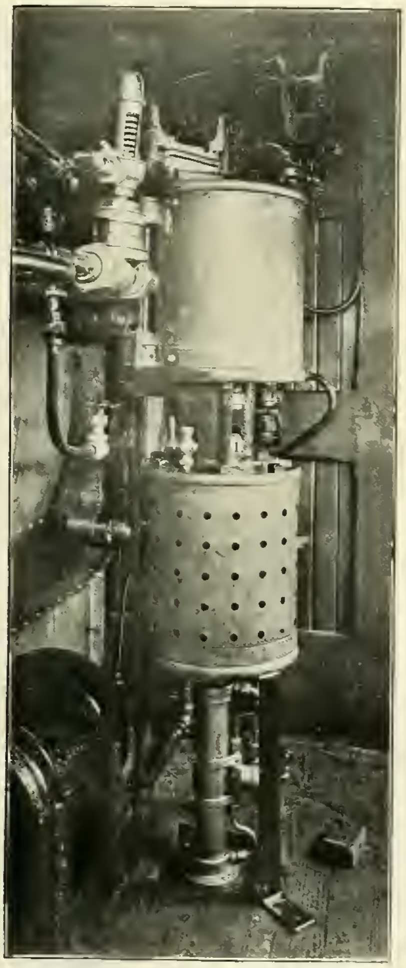


AN INTERIOR VIEW OF THE PITTSBURGH & WESTERN INSTRUCTION CAR.

For six months, ending June 30, 1899, the British Board of Trade records several serious accidents due to the failure of the vacuum brake and automatic vacuum brake to act on English railways. The report gives no failures of the Westinghouse brake to act when required. The ratio of the Westinghouse brakes on engines and passenger cars in England to the vacuum brakes is about 1 to 3; while a considerable number of the engines and cars are equipped with both systems.

Real Names and Addresses Should be Signed.

We have repeatedly requested persons sending correspondence to these columns to send us their names and addresses; yet there are some, who, for reasons real or fancied, continue to write us over *noms de plume* and give fictitious addresses.



WORKING SECTIONAL AIR PUMP.

It is really necessary, in order to do our correspondents justice and save ourselves unnecessary work, that the real name and address of the writer shall accompany each letter. If, for any reason, a writer does not wish his name published with his article, we will gladly withhold his name, signing any fictitious name he sees fit to assume. But we must have the real name and address of the writer in case we find it necessary to write him for further data, or to give a lengthier and more detailed personal reply to his communication than space in our columns will permit.

We avoid, as far as possible, discussions and the answering of queries by private letter; yet we sometimes find it unavoidable, and are obliged to do it. We find it very trying and discouraging to have a letter which has taken considerable time and research to collect reliable data and prepare for a favored correspondent, returned to us stamped "No such person here." Such a letter has been returned us, sent to "Robinson & Howell, Mattoon, Ill.," and may be had by those parties writing us. Sign name and address to all letters.

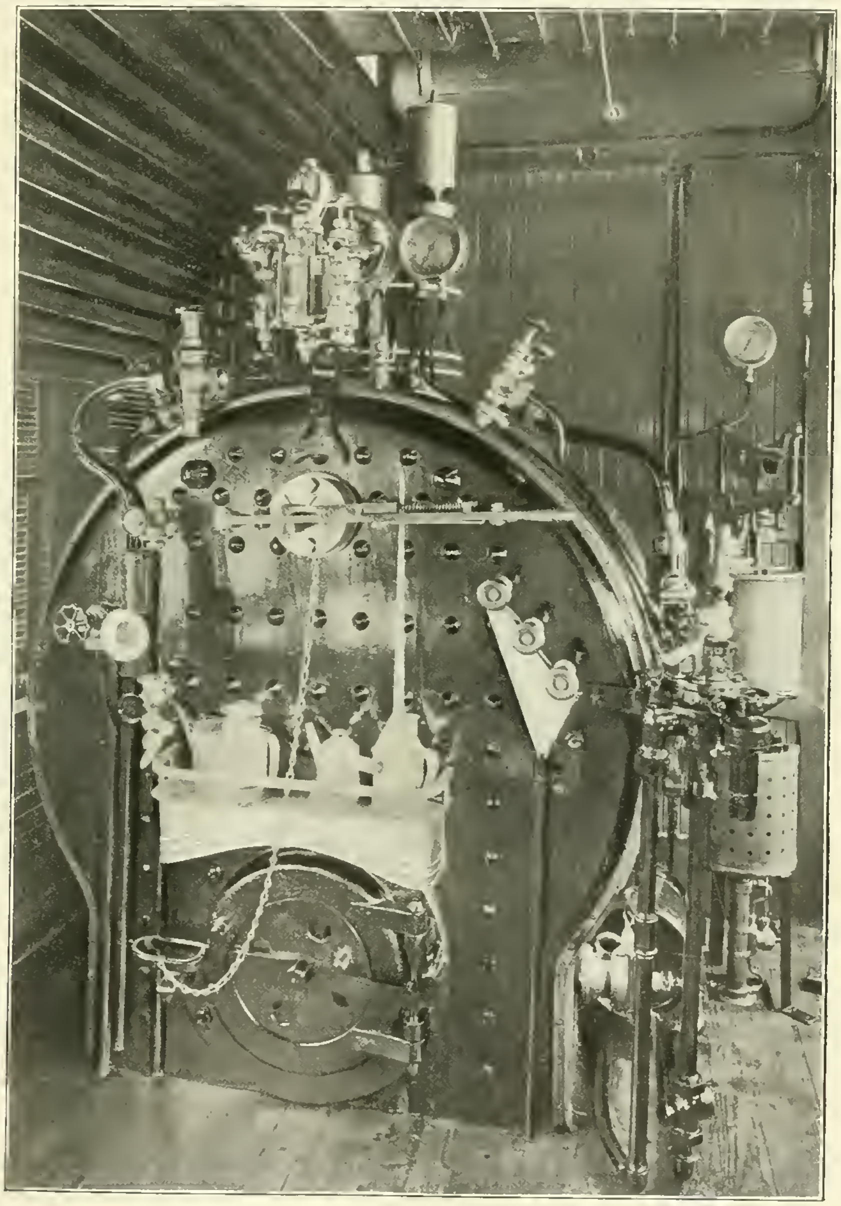
CORRESPONDENCE.

Further Data Desired on Air Brake Tests.

Editor:

Your article in the February number, stating the result of tests conducted by Messrs. Goodwin and Farmer, was very interesting. I think results of such air-brake tests are always productive of good. If the test is a success we all get new ideas, while if the test is a failure we get ideas that should be discarded.

I would like very much to have a little more data added than that given by the gentlemen who conducted the tests. I would like to know the capacity of the main reservoir used on the engine, the kind of pump, whether the engine was equipped with any device other than the ordinary engine equipment, the percentage of braking power used on this company's cars, the number of cars in the train, the number of air-brake cars deemed necessary or that were used, also an idea of the lading or total tonnage handled on those grades. Such tests can only be of use to others, and can only be accepted as good practice for one's own road, when full information is given.



DUMMY BOILER AND SECTIONAL BOILER HEAD FITTINGS IN PITTSBURGH & WESTERN INSTRUCTION CAR.

This is in no way meant to be a criticism on the article published; but the idea is rather to get at some of the fundamentals that constitute the successful manipulation of the air brake in order to procure safety in handling trains by air on heavy grades.

I wish we might read more through your columns of such tests conducted in different parts of the country where there are varied grades, difference in the length of trains and lading, train line pressure carried, percentage of braking power employed, and other facts that form a basis for comparison with methods employed on one's own work.

Robert H. Blackall,
A. B. Inspr., Delaware & Hudson Ry.
Oneonta, N. Y.

[The desired data will be given in next month's number.—Ed.]

Peculiar Action of a Triple Valve.

Editor:

Here is a little air-brake question partly answered that I would like to have your opinion on:

What will cause a plain triple valve to draw air in through the exhaust port?

I cleaned and oiled a driver brake triple valve a few days ago, and after I put the valve together and started the pump air started to flow in through the exhaust port of the triple valve, enough to take in most all of the blaze of a torch.

I watched it until the maximum pressure was pumped up. For experiment, I disconnected the pipe leading to the brake cylinders at the first union joint from the triple valve, and found air was going to the cylinders, but it had not force enough to set the brake. I held my hand over the end of the pipe and the air then came out through the exhaust, but when I removed my hand the air took its former course through the pipe.

I then connected the pipe and looked for a leak in the pipe or cylinder packings and the air was escaping around one of the cylinder packing leathers.

Now, it looks plain enough that air was escaping from under the face of the slide valve and was going to the brake cylinders, which induced a current and caused a suction through the exhaust port, but it does not look quite clear to me why the air should go through the pipes instead of blowing out the exhaust, the defective packing being on the opposite side of the engine, and the pipes leading to it are quite long and crooked.

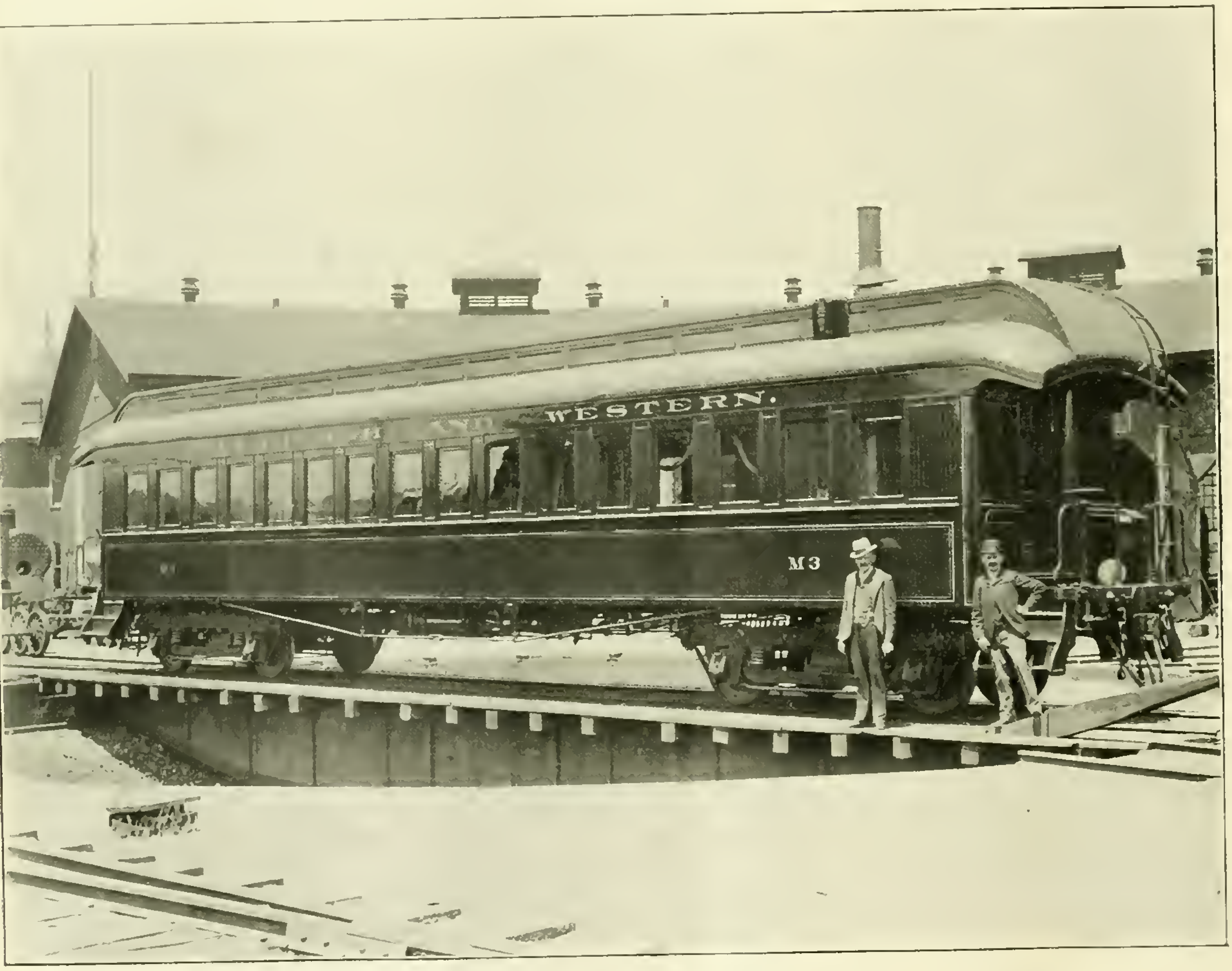
I applied the brakes and they set all right, and the packing was perfectly tight as soon as air entered the cylinder with force enough to expand the packing to the sides of the cylinder.

When I released the brake everything was all right.

The trouble was probably caused from a small particle of dirt which held the slide valve from its seat, but was removed as soon as the slide valve moved.

Theron H. Williams,
Air Brake Inspector, C., M. & St. P. Ry.
Chicago, Ill.

[Your trouble with the driver brake triple valve would seem to be possible as you describe it. Perhaps the slide valve was not in full release position and dirt was so located between the face of the slide valve and seat that there was a passage of air rushing in the direction of the cylinder port, which produced the same action that the injector does when forcing water to the boiler. In the injector, so long as the boiler check valve is open, the water goes direct through the branch pipe to the boiler and does not attempt to get out through the overflow at all; but when the injector "breaks," then the water comes back through the overflow. You might say that dirt or a bit of waste lint so formed between the slide valve and seat as to produce the principle of the injector.—Ed.]



EXTERIOR VIEW OF PITTSBURGH & WESTERN INSTRUCTION CAR.

The Engine Truck Brake.

Editor:

I wish to say a few words in regard to engine truck brakes, as I have heard several arguments brought up against their use.

It is said that engine truck brakes cause hot journals in two ways, one of which is by the brake shoe scraping the dirt from the flange of the wheels and throwing it, together with the metal worn from the shoes, upon the journal at the hubs, thereby causing them to heat. Again, it is alleged that the journals are forced out of their position against the leg of the truck box; also that if the brakes are kept in good order there is danger of skidding the wheels. And, further, it is claimed that much of the leaking at the steam pipe joints is caused by the use of this brake.

My experience in this matter has been on long runs, and few stops, and it fails to confirm any of these arguments, with the exception of the skidding of wheels, which is had only with a bad rail. Now, in case of a bad rail we can do good braking without skidding the wheels by a proper use of sand on all the brakes except the engine truck brake. Let me say right here that I feel sure it is a silent satisfaction with some men to allow long piston travel or a leak beyond the triple valve, and even, by some, to cut out this brake to insure themselves against these troubles.

As it is always desirable to have a good brake, and that in good order, I should be in favor of cutting down the braking force on the engine truck brake to a strictly safe limit. Then use a flangeless shoe, to avoid throwing dirt on the journals. I think in this way it would inspire confidence in men who use them; or, rather, men who have them and do not use them. The brake would be better cared for, and would bring better results than it would otherwise do.

If there is anything in the steam-pipe question, my experience has failed to confirm it. I would like to hear what others have to say on the matter.

Pittsfield, Mass. N. B. Parrish.

Sticking Brakes Due to Sanding Device

Editor:

I have been on a heavy freight train climbing a 2 per cent. grade on which there is a tunnel with a very sharp curve. The engines here are equipped with the air sanding device. The air is taken from the main reservoir pipe, close to the engineer's brake valve. On this occasion I did not have to use the sand blower until I approached this tunnel. There I turned on the sand blower, and before I got half way through (the distance being 1,400 feet) the brake commenced sticking. At the approach, going out, the fireman bled off the brake, but that did not relieve my trouble. We stalled.

I cut off the engine and put it on straight track, set the brake, and found driver brake pistons to be adjusted to about 2¼ inches on left side and ¾ inch on right side. The curve led to the right and the shoes clung to wheels on left side, while on the curve. I concluded that this was causing my trouble. I put the engine over the first available pit and let the brake out to about 5 inches. Then I turned on the sand blower and found brake would set the same as in first place.

These engines are equipped with the New York duplex air pump and governor, the McKee-Vaughan brake valve and push-down brake pistons. Engineers don't carry this valve in running position. They claim from the time that valve is brought to running position until excess pressure is obtained that the brakes will set on the engine; also that the equalizing reservoir which goes with this valve is charged from the train line, which would also cause brakes to set on the engine the same as by using the sand blower.

In my opinion what causes this trouble is that air passes back to the sand blower at the same time it comes from main reservoir pipe, causing brake to set on engine, and especially so where the brake adjustment is too tightly taken up. Sometimes the governor is not sensitive enough and pump is sluggish in starting.

Now, I wish you would let me know as soon as possible what you think causes this trouble and the best remedy to overcome it. Thomas Caffrey.

Leavenworth, Wash.

[Your solution of the problem seems a sensible and correct one. The trouble is undoubtedly caused by the sand blower, and will disappear when the blower is cut out. The sand blower has been known to take about half the air made by the pump. This trouble, and also that of being unable to carry your brake valve handle in running position is aggravated by the sluggish-working governor. We do not believe the brake valve is responsible for the trouble mentioned, unless you have no excess pressure. A better adjustment of driver brake piston travel should be had. Too short travel will tell on curves and when boiler is not carrying maximum amount of water.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(32) L. M. A., Minneapolis, Minn., asks:

Does not a short piston travel give more braking power than a long one? A.—Yes; but the shorter travel must be sufficiently long to pass beyond the leakage groove and not stop on it.

(33) W. A. R., Glenwood, Pa., asks:

Is there any defect which will cause air to flow through the pressure retaining valve other than a bad emergency valve? A.—Yes; a leaky slide valve, bad gasket between triple valve and auxiliary reservoir on freight car, or between triple and brake cylinder on a passenger car and a leaky tube in auxiliary reservoir of freight brake.

(34) H. H., Wymore, Neb., asks:

1. How much smaller in diameter should the main piston head be than the cylinder in the 6, 8 and 9½-inch pumps? A.—1. The piston heads of all the pumps, both steam and air ends, are turned 1-64 inch smaller than the bore of the cylinder. 2. How much larger in diameter should the packing rings be turned than the cylinder in the 6, 8 and 9½-inch pumps? A.—2. One-eighth inch larger than the bore of the cylinder before the rings are split.

(35) W. O. D., Cleveland, O., asks:

Was the New York air brake explained in your paper? If so, in what paper was it? A.—Only in such a way as the questions of correspondents from time to time have called forth answers, the same as with the Westinghouse, Boyden, Lansberg, and other makes of air brakes. However, arrangements have been made to illustrate the principal parts of the apparatus in the near future. The train drain cup, or air strainer, was illustrated in the March number.

(36) R. & H., Mattoon, Ill., writes:

Six-inch driver brake cylinders are put up with an auxiliary intended for 8-inch brake cylinders. What train pipe pressure should be carried to have the same braking force as would be given with the proper size auxiliary for the 6-inch cylinders? A.—About 56 or 57 pounds in an auxiliary reservoir designed for an 8-inch brake cylinder would give about 50 pounds, equalized pressure, in a 6-inch cylinder whose piston stroke was between 6 and 7 inches. Air-brake parts, however, should never be so arranged.

(37) H. H., Wymore, Neb., asks:

Should a pump governor stop the pump entirely, or let it run slowly? A.—The pump should not be stopped entirely. Recent pump governors have a small pinhole drilled through the steam valve to permit a small quantity of steam to pass to the pump and keep it moving, even though the governor has closed the steam valve. This arrangement prevents steam in the pump from condensing and being thrown out of the stack on to jacket and paint work when governor releases pump. Also freezing of the pump parts is prevented in cold weather.

(38) H. H., Wymore, Neb., asks:

Would it pay to bore out main valve bushing, or should they be renewed when worn too much? A.—Some roads believe it advantageous to bore out these bushings, while others find it more desirable to replace worn bushings with new ones. This latter plan seems preferable, as it maintains standards; where with the former method two or more standard sizes of material would have to be carried in stock. It is pretty generally believed that a bush which has become sufficiently worn to require renewal has earned a place for a new one.

(39) L. W. K., Truro, N. S., Canada, asks:

What is the Westinghouse and the American brake combined? A.—The American Brake Company, at St. Louis, Mo., manufactures the brake rigging for the driver and truck brakes, and the Westinghouse Company supplies the pump, governor, brake valve, cylinders, triples, auxiliaries and other parts necessary to operate those brakes. Thus, an engine brake with foundation gear furnished by the American Brake Company and operative parts by the Westinghouse Air Brake Company is called a Westinghouse American brake.

(40) W. A. R., Glenwood, Pa., asks:

Which would be the quickest way to repair an air brake which leaks off when it should stay on? Can it be repaired without the removal of the packing leather? A.—First look at the pipe connections to the cylinder and see that they are tight. Then test the packing leather. The better way to repair a leaky leather is to take it out of the cylinder. By flooding the cylinder with oil through the oil plug, the leather may be softened up; but this oil gets into the triple and does damage there. Remove the leather. This remedy, of course, applies only to a brake that leaks off and which does not whistle off through the triple.

(41) J. W. B., Lebanon, Pa., writes:

In putting on the brake with 10 pounds, and standing for a short while, the white hand goes back to zero, and the brake releases. Is that in the valve or in the cylinders? A.—Your trouble probably lies in both the train pipe and brake cylinder. The dropping to zero of your white or train pipe hand indicates a bad leak in your train pipe. The releasing of your brake indicates a leaking packing leather in your brake cylinder or a loose pipe joint thereto. If the leather and pipe joints were tight, the dropping to zero of your train line pressure would apply your brake fully, and it would remain set; but your total loss of both train pipe and brake cylinder pressure proves that you have had leaks as mentioned above.

(42) C. H. W., Danville, Ill., writes:

Will you please explain the difference between the D-5 and E-6 engineer's brake valve? A.—The D-5, E-6 and F-6 brake valves are the same, or practically so. The D-8 brake valve was the first equalizing valve in general practice. It had an excess pressure valve. The D-5 valve was the next valve put out. It had the same equalizing feature; but instead of the excess pressure valve, it had the new feed valve attachment which is so commonly used to-day. When the manufacturer revised his catalogue of brake apparatus he gave the D-5 valve a new name and called it E-6. The later revision calls this same valve F-6. Air-brake men, in order to avoid confusion, have agreed to call the D-8 valve the "1890 model," and the D-5, E-6 and F-6 the "1892 model."

(43) J. W. B., Lebanon, Pa., writes:

I am handling a new engine on which is a 9½-inch pump and equalizing brake valve. It is a new thing to me, as I am used to the steam brake. I have been handling the air brake about four months, and had no trouble until recently, when the reservoir pressure ran up to 105 pounds, which it still does at times. Not all the time; only once in a while. Please tell me what is the matter with it. A.—The diaphragm valve or pin valve in your pump governor is probably in a gummy condition, and occasionally prevents the air from passing to the steam piston to shut down your pump. The diaphragm valve raises just the same at all times, but the gummy deposit will stretch like rubber, and, although the valve is off its seat, the gum prevents the air from passing to the port. Clean the diaphragm valve occasionally, keep your main reservoir well drained and use less oil in the air cylinder of your pump.

(44) L. W. K., Truro, N. S., Canada, writes:

I have seen main reservoir air pressure rise to 120 pounds with 105 pounds boiler pressure. What will cause this? A.—This was most likely done with the 8-inch pump, whose steam piston head is 8 inches in diameter and air piston head 7½ inches. Thus it will be seen that it is possible to get a higher air pressure than the steam pressure in the boiler. Years ago, when the 8-inch pump was designed, the steam pressure carried on locomotives was about 110 to 130 pounds; and in order to get a sufficiently high main reservoir pressure, the above mentioned difference was made in the steam and air pistons of the pump. But now, when steam pressures on modern locomotives range anywhere between 160 and 225 pounds, an air pump with equal diameter of air and steam piston heads will supply a sufficiently high pressure of air; hence, the 9½-inch pump with steam and air piston heads of the same size.

(45) L. W. K., Truro, N. S., Canada, asks:

What is wrong with New York engineer's valve when making a service application the train line exhaust will not close until the valve is placed on lap position and kept there? A.—The leather packing in the equalizing piston leaks, or there is a leak somewhere in the equalizing reservoir pressure. In the former case, pressure from the equalizing reservoir would leak past the leather packing into the train pipe, and the piston would not close the train pipe discharge; but would allow equalizing reservoir and train pipe pressures to reduce alike. Leakage of equalizing reservoir pressure prevents the expansion necessary to carry the equalizing piston to the position to cut off the discharge from the train pipe. Hence, the brake valve handle must be returned a trifle towards lap position, but not necessarily all the way to lap position notch. Put in an air-tight packing leather and look after chamber D connections.

(46) L. W. K., Truro, N. S., Canada, writes:

Which train will stop in shortest distance, two cars and engine or twelve cars and engine, all conditions being equal? If any difference please explain why. A.—The question can be best answered by taking a specific case. A locomotive weighing 100,000 pounds is braked to 75 per cent., as usual, on her drivers, but has no truck brake. Say one-third the weight of the engine is on her truck. Then the weight of the engine unbraked is 49,500 pounds (33,000 pounds, the unbraked truck weight, plus 16,500 pounds, the 25 per cent. unbraked weight on the drivers). The tender is braking at 90 per cent. of its weight. The twelve cars are also braking at 90 per cent. of their weight. We will first cut the engine off from the tender and train, get up a certain speed, apply the brake, make a stop and measure length of stop. Now, couple on the tender, get up same speed, make stop and measure the distance, which will be found to be shorter than that made with the light engine; for the tender, braking to a higher percentage, has helped stop the engine. Now, couple on two cars and the stop will be shorter still; for the cars and tender now help hold the engine. Put on twelve cars, and the stop will be shorter yet; for twelve cars will hold the engine back more than the tender or two cars can. It is mainly a question of holding back the engine.

(47) L. W. K., Truro, Nova Scotia, Canada, writes:

Had four air cars in train. Remainder were non-air; brakes O. K. before starting. When about 5 miles out the driver brake crept on. I put engineer's valve in full release and driver brake released. Returned valve to running position after brake released, but it soon applied again. It acted in this manner two or three times. I stopped train and found brake on drivers, first, third and fourth cars applied. Tender and second car not applied. I cut driver brake out; always had proper amount of excess pressure; had no trouble with driver brake before. What would cause this? A.—If you could release your brakes by placing brake valve handle in full release and could not hold them off by carrying valve handle in running position, it would indicate that somewhere the air was leaving your train pipe faster than the running position would put it in. Your excess valve might have been open, but the passageway restricted by dirt. Brakes with short piston travel and leakage grooves clogged are the first ones to stick when train pipe leaks. The long travel pistons use more air than short travel, and therefore draw from the train line even after the short travels have charged fully. This aggravates the train pipe leak and causes undue blame to fall on short travels. To avoid this trouble keep brake valve handle out of release position, except for a second or two when releasing brakes. This will throw triples to release position, and the charging should be done in the running position.

Personal Department.

President James Henry Smart, of Purdue University, died on February 21st.

Mr. Robt. Woodburn has been appointed master mechanic of the Halifax & Yarmouth at Yarmouth, N. S.

Mr. C. J. Kennedy has been appointed assistant superintendent of the Worcester division of the New York, New Haven & Hartford.

Mr. A. M. Wilson has been appointed superintendent of the Gettysburg & Harrisburg at Reading, Pa., vice Mr. O. R. Doolittle.

Mr. John W. Fitzgibbon, for the last year superintendent of motive power of the Delaware, Lackawanna & Western, has resigned.

Mr. A. J. Troup has been appointed division superintendent of the Canadian Pacific at Nelson, B. C., vice Mr. H. E. Beasley, transferred.

Mr. George H. Emerson has been appointed general master mechanic of the Western district of the Great Northern at Spokane, Wash.

Mr. Curtiss Millard, superintendent of the Chicago, Peoria & St. Louis, has been appointed general manager, with headquarters at Springfield, Ill.

Mr. J. F. Sheahan has been appointed master mechanic of the Southern at Selma, Ala., succeeding Mr. J. T. Robinson, transferred to Spencer, N. C.

Mr. M. T. Fisher has been appointed master mechanic of the Great Northern, vice Mr. J. R. Van Cleve, resigned; headquarters at Kalispell, Mont.

Mr. H. R. Doty has been appointed engine dispatcher on the Lake Shore & Michigan Southern Railroad at Elkhart, Ind., vice E. C. Hart, resigned.

Mr. W. W. Atwood, superintendent of the Buffalo & Susquehanna, has resigned to accept a similar position with the Clarion River at St. Marys, Pa.

Mr. W. H. Churchill has been appointed train master of the Kansas City, Memphis & Birmingham, vice Mr. H. A. Ford, resigned; headquarters at Amory, Miss.

Mr. Charles F. Smith has been appointed engine inspector and air brake instructor for the Terminal Railroad Association, with headquarters at St. Louis.

Mr. H. D. Norris has been appointed acting purchasing agent of the Pere Marquette, vice Mr. R. Wallace, resigned; office at Grand Rapids and Saginaw, Mich.

Mr. H. M. Carson, assistant engineer of motive power of the Pennsylvania at Altoona, has been appointed master mechanic at Pittsburgh, vice Mr. D. O. Shaver.

Mr. James Cunningham has been appointed general master mechanic of the Choctaw, Oklahoma & Gulf and Choctaw & Memphis, with headquarters at Shawnee, O. T.

Mr. J. O. Reed has been appointed superintendent of the Pittsburgh, Johnstown, Ebensburg & Eastern, vice Mr. U. S. Houck, resigned; headquarters at Ramey, Pa.

Mr. Thomas Roope has been appointed general master mechanic of the Eastern district of the Great Northern and the Willmar & Sioux Falls, with office at St. Paul, Minn.

Mr. J. R. Booth, foreman of the Southern shops at Salisbury, N. C., has been appointed to the position of master mechanic of the Carolina & Northwestern at Chester, N. C.

Mr. D. Mills, train master of the St. Louis Southwestern at Pine Bluff, Ark., has resigned to accept a similar position with the Kansas City, Pittsburg & Gulf, at Pittsburg, Kan.

Mr. R. H. Brown, superintendent of the St. Louis Southwestern at Pine Bluff, Ark., has been appointed general superintendent, with office at Tyler, Texas, vice Mr. F. H. Britton.

Mr. G. A. Clark, train master of the Illinois Central, has been appointed superintendent of the Fort Dodge & Omaha division of the Illinois Central at Fort Dodge, Iowa.

Mr. J. E. O'Hearne, master mechanic of the Wheeling & Lake Erie at Norwalk, Ohio, has had his jurisdiction extended over the territory formerly covered by Mr. John Bean, resigned.

Mr. H. W. Wallace has been appointed assistant superintendent of the Evansville district of the Louisville division of the Illinois Central, with office at Evansville, Ind., vice Mr. A. H. Egan.

Mr. W. L. Gilmore, late master mechanic at Elkhart, Ind., on the Lake Shore & Michigan Southern Railroad, has entered the service of the Keasbey & Mattison Company, at Ambler, Pa.

Mr. J. R. Van Cleve has been appointed master mechanic of the White Pass & Yukon at Skaguay, Alaska. He has heretofore been master mechanic of the Great Northern at Kalispell, Mont.

Mr. J. W. Williams, division master mechanic of the Delaware, Lackawanna & Western at Syracuse, N. Y., has had his duties extended over the Utica division, vice Mr. T. Thatcher, transferred.

Mr. Martin Monroe, of the Denver & Rio Grande, has been appointed traveling engineer of the Choctaw, Oklahoma & Gulf and Choctaw & Memphis, with headquarters at North Little Rock, Ark.

Mr. William Shriver, engineer on the Pittsburgh & Western, and who suffered the loss of a hand several months ago, has been appointed traveling fireman, vice Mr. I. T. Ward, assigned to other duties.

Mr. C. J. Robinson, purchasing agent of the American Tool Works, Cincinnati, O., has resigned to become vice-president and general manager of the Wais & Roos Punch and Shear Company of the same city.

Mr. Thomas F. Hastings, trainmaster of the Chicago, Burlington & Quincy at Minneapolis, Minn., has been appointed to succeed Mr. Robert Dudgeon as superintendent of the Minnesota Transfer Railway at St. Paul, Minn.

Mr. B. H. Hawkins, general foreman of the Chicago, Rock Island & Pacific shops at Chicago, has resigned to accept the position of master mechanic of the First division of the Denver & Rio Grande at Denver, Colo.

Mr. E. Elden has been appointed master mechanic of the Eastern division of the Fitchburg at Boston, Mass., vice Mr. F. C. Smith, resigned. He was formerly with the Lake Shore & Michigan Southern at Buffalo, N. Y.

John M. Holt, general foreman of car repairs on the Southern at Washington, D. C., died of paralysis on Feb. 25. He was an active member of the Master Car Builders' Association, and highly esteemed by all who knew him.

Mr. Robert Dudgeon, superintendent of the Minnesota Transfer Railway at St. Paul, has resigned to accept the position of division superintendent on the Delaware, Lackawanna & Western; headquarters at Buffalo, N. Y.

Mr. W. H. Holbrook has been appointed acting assistant road foreman of engines on the Pittsburgh division of the Pittsburgh, Cincinnati, Chicago & St. Louis, in place of Mr. J. C. McCullough, temporarily tran ferred to special service.

Mr. Herbert N. Breneman has been appointed general inspector of boilers on the Baltimore & Ohio, with office at Mt. Clare, Baltimore, Md. Heretofore he has been foreman of the West Milwaukee shops of the Chicago, Milwaukee & St. Paul.

Mr. Russell Harding, vice-president and general manager of the St. Louis Southwestern, has resigned to accept the position of general manager of the Missouri Pacific, vice Mr. William B. Doddridge, resigned; headquarters at St. Louis, Mo.

Mr. H. C. Nutt, assistant superintendent of the Burlington & Missouri River at Sheridan, Wyo., has resigned to accept the position of assistant superintendent of the Iowa division of the Chicago, Burlington & Quincy, with office at Burlington. Iowa.

Mr. George A. Hancock, recently appointed master mechanic of the Atchison, Topeka & Santa Fe, has resigned to become superintendent of machinery of the St. Louis & San Francisco, with office at Springfield, Mo. He succeeds Mr. J. R. Groves.

Mr. A. A. McGregor, car foreman and wrecking master of the Cincinnati Southern at Somerset, Ky., has been appointed train master of the Chicago & Alton. We have received some very kindly expressions about Mr. McGregor from parties on the Cincinnati Southern.

Mr. E. G. Russell, general superintendent of the Delaware, Lackawanna & Western, has been given a leave of absence and will go to Europe for the benefit of his health. Mr. J. M. Daly, superintendent of transportation, will perform Mr. Russell's duties during his absence.

Mr. J. H. Murphy, master mechanic of the New Orleans & Northeastern, Alabama & Vicksburg and Vicksburg, Shreveport & Pacific, has resigned to accept a similar position on the Cincinnati, New Orleans & Texas, vice Mr. V. B. Lang, resigned; headquarters at Chattanooga, Tenn.

Mr. John Smith, roundhouse foreman of the Buffalo, Rochester & Pittsburgh shops at Du Bois, Pa., has been appointed master mechanic of the Pittsburgh division. He has also been given supervision of the Du Bois car shops, to succeed Mr. F. G. Lauer, master car builder, resigned; headquarters at Du Bois, Pa.

Mr. Eugene McAuliffe, whose writings are well and favorably known to our readers, has received leave of absence from the Kansas City, Fort Scott & Memphis Railroad to enter the service of the International Correspondence School, Scranton, Pa. We predict a very successful career for Mr. McAuliffe as an educator.

The following appointments have been made on the Baltimore & Ohio: Mr. Thomas Fitzgerald, general superintendent of the Philadelphia division and the main line and branches, including the West Virginia & Pittsburgh Railroad; office at Central Building, Baltimore; and Mr. J. C. Stuart, general superintendent of the Middle and North-Western divisions (formerly know as the Trans-Ohio division); office at Chicago.

Mr. J. R. Lusk, for several years chief dispatcher of the Pittsburgh & Western Railway, has been promoted to the newly created office of assistant superintendent, with headquarters at New Castle Junction, Pa. Mr. Lusk has been in the employ of the Pittsburgh & Western Railway for a number of years, and has risen to his present position from that of operator by hard work and close attention to business. He is succeeded as chief dispatcher by Mr. J. B. Reed, formerly "first trick" man on the Eastern division.

The following changes have been made on the Baltimore & Ohio: Mr. P. Hayden, appointed general foreman at Benwood, in place of Mr. J. F. Prendergast, transferred; Mr. J. F. Prendergast, appointed general foreman at Grafton, W. Va., in place of Mr. P. Hayden, assigned to other duties; Mr. P. J. Harrigan, appointed general foreman at Connellsville, Pa., in place of Mr. D. Witherspoon, transferred; Mr. D. Witherspoon, appointed general foreman at Cumberland, Md., in place of Mr. P. J. Harrigan.

Mr. T. S. Lloyd, master mechanic of the Chesapeake & Ohio shops at Richmond, Va., has resigned to accept the position of superintendent of motive power of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa. Mr. Lloyd has been a graduate of the Chesapeake & Ohio, and was in high favor with the management. He was recommended to Mr. W. H. Truesdale, president of the Delaware, Lackawanna & Western, by Mr. W. S. Morris, superintendent of motive power of the Chesapeake & Ohio.

The railroad department of the *Pittsburgh Post*, which has within a few years become the best railroad department of any daily paper, is under the management of Mr. T. E. Malone, who is a practical railroad mechanic and avoids the mistakes that the ordinary reporter is so ready to fall into when writing about railroad matters. Besides being a good railroad editor, Mr. Malone is a geologist of some note and a keen sportsman. He writes special articles on all subjects from geology to astronomy, and his hunting and bear stories have been reprinted in papers from Maine to California. Hunting is a favorite sport of his, and he has some records at the trap, breaking 98 out of 100 clay birds from five unknown traps. A great friend is an English setter named Richard III, or "Dick" for short.

One of our railroad friends recently put the question of subsidizing steamships in a very plain way: "A steamship is practically a combination of a steel car and a locomotive. We make both of these and sell them all over the world without ever thinking of a subsidy. Yet the shipbuilder seems to think he can't go in and win without being coddled by the Government."

The staybolt tap which is hollow and threaded and works on a threaded spindle was first got out in the Missouri Pacific Shops, at St. Louis, Mo. One of Mr. Bartlett's ingenious mechanics got it out. It was afterwards patented by a pirate, and is reported to have made considerable money for the appropriator.

Addison C. Rand.

The death of Addison C. Rand on March 9 removes one of the pioneers in rock drills and air compressing machinery. Born in Westfield, Mass., in 1841, he

ADDISON C. RAND.

had long been connected with manufacturing interests, but is best known as the president of the Rand Drill Company. His work in this connection is well known to nearly all mechanics.

To Stop Flange Cutting.

The Southern Pacific locomotives working on the Tehachapi Mountain have water pipes leading from the tender up to the front end of the engine, where a small jet of water is turned against the flanges of the leading pair of engine truck wheels, which prevents some of the wear—thus keeping the flanges cool. Some of the engines have water applied to the first flanged driving wheels also.

The water is used when coming down the mountain, but not when going up, as the engines would slip when pulling hard. The track going down the mountain on the west side is probably as crooked as any standard gage track in the United States. The longest tangent is less than sixty car-lengths long. In the 25 miles between Tehachapi and Caliente there are eighteen tunnels, and the drop in the grade is close to 2,800 feet.

Going up hill they use lots of coal. Coming down they hold the train with the air brake and use plenty of retainers.

A committee of the Traveling Engineers' Association, appointed to investigate "the use of the steam engine indicator as an aid to the traveling engineer to determine the efficiency of the locomotive in service and the benefits derived therefrom," are calling upon members for facts on which to base a report. The facts concerning the use of this useful instrument are not nearly so plentiful as they ought to be. Any man having used the indicator on locomotives ought to send particulars without fail to Mr. George W. Wildin, Plant System, Savannah, Ga.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(32) J. M. N., Columbus, Ohio, writes:

What are the positions of the eccentrics on the axle in relation to the crank pin? A.—This is the kind of information that ought to be looked up in some book on the locomotive.

(33) E. F. G., Newcastle, Wyo., asks:

Will you please tell me which are the main drivers on a consolidation, those with the eccentrics on the third pair of drivers that have the main rod attached? A.—The main driver is that to which the main rods are connected.

(34) W. R. H., Watervliet, N. Y., asks:

I have a new headlight. When it was first put on it would go out. I put a sleeve on the top, so most of the draft was closed. Then it burned all right; but when the whistle is blown it will almost go out. A.—The blowing of the whistle makes the air vibrate so violently that it tends to cut off the supply of air passing through contracted openings.

(35) R. H. C., Rat Portage, Ont., writes:

Please say why a Pittsburgh cross over compound should be put in simple while running down grade with steam shut off? Should a four-cylinder compound be put in simple while running down grade with steam shut off? If so, why? A.—Both should be put in simple to prevent the pistons from acting as air-pump plungers.

(36) R. C. O., New York, N. Y., asks:

1. In your February issue, on page 83, a reference is made to a Cooke locomotive having two pairs cast-steel and two pairs cast-iron wheels. Why is that? A.—1. The cast-steel centers are placed on the wheels where the designers believed the greatest stresses come. 2. How much does the ten-wheel New York Central engine, described in your August number, weigh? A.—2. About 152,000 pounds.

(37) W. J., Rat Portage, Ont., writes:

1. What is the usual speed to run consolidation engines with 50-inch driving wheels? A.—1. That depends on the rules of the road; all the way from 20 to 60 miles per hour. 2. How much coal per square foot of grate surface per hour can be burned, so that smoke can be consumed properly? A.—2. No approximate answer to this can be given; so much depends upon the fireman and quality of coal.

(38) C. H. W., Danville, Ill., asks:

Does the crown-sheet of boiler get hot while engine is in service, or does same rule apply to this as to tea kettle? There has been quite an argument among engineers here in regard to the matter. A.—We do not know what rule you refer to as applying to a tea kettle, but we know that the crown-sheet of a locomotive or any other kind of boiler will get hot if the water is permitted to boil below it.

(39) C. M. C., New Orleans, writes:

Would you please inform me through your valuable journal of the proper way to key up side rods on a mogul and consolidation engine? Does it depend on the way the keys are situated or knuckle joints when engine is on center? A.—Place the engine on center so that the crank pins will be the same distance apart as the center of axles. Key up the middle connection of side rod first, then the front and back, as they can be more readily adjusted the proper length.

(40) F. C., Truro, N. S., asks:

Would you inform me, through your question department, what size exhaust a 20 x 26 engine should have with short exhaust pipe, with petticoat pipes, and netting on an angle from top of smokebox? Al o, how should this pipe be placed in front end as regards the distance between tip and pipe? Engine cleans all the sparks out of front end and tears fire badly, consequently burning too much coal and not steaming freely. A.—This subject is very exhaustively treated in a report beginning on page 30 of the Master Mechanics' Annual Report for 1891. The subject is too comprehensive to be treated in this department.

(41) G. J., Wilkesbarre, Pa., writes:

I would like to ask a few questions in regard to compounds. 1. Why should the lever never be hooked up, shortening the valve travel, until the cylinder cock lever has been put into compound position? A.—1. It would cause too much compression. 2. Why will the engine slow down if you use it when hooked up? A.—2. Because it is suffering from compression. 3. What is the mean effective pressure in the low-pressure cylinder of an engine carrying 200 pounds boiler pressure? I do not suppose it can be given correctly without an indicator. Just give an estimate. A.—3. See Sinclair's "Engine Running," 1899 edition, page 315.

(42) F. L. H., Sioux City, Ia., asks:

I would like to have an argument settled which is evenly divided on our division. Some claim a lubricator does not feed oil to the valves when an engine is working full throttle; that the oil leaves the lubricator, feeds drop after drop, but it backs up in oil pipes near steam chest, and when engine is shut off the valves then receive the oil. This is a Nathan lubricator, and engine carries 170 pounds of steam. I claim when a drop of oil leaves lubricator feed it is forced direct to the valve. A.—With some lubricators the oil does not go to the cylinders when engine is working with throttle wide open, but the improved attachments in use now make the oil go direct to the cylinders, no matter how the engine is working.

(43) A. J., Sioux City, Ia., asks:

1. Double-headers are in evidence here just now, and we have on all fast freights ten-wheel, 19 x 21 engines, and as a helping engine we have eight-wheel, 17 x 24 Baldwins. I say the small engine should be put ahead, as a matter of safety and economy, as I consider it would be hard on the small engine if she was put behind the larger one. A.—1. We do not consider that it makes any difference whether the light engine is in front or next to the train. 2. Why can't two engines so coupled together pull their full tonnage over a 65-foot grade? One engineer told me that two engines of same size and class, working the same, did not pull equal amount of tons each, as the head engine would pull less; but he could not explain why. A.—2. Tests seem to indicate that two engines hauling a train will not pull double the load that one is capable of hauling. We do not know what the cause of this is.

(44) J. A. M., Omaha, Neb., writes:

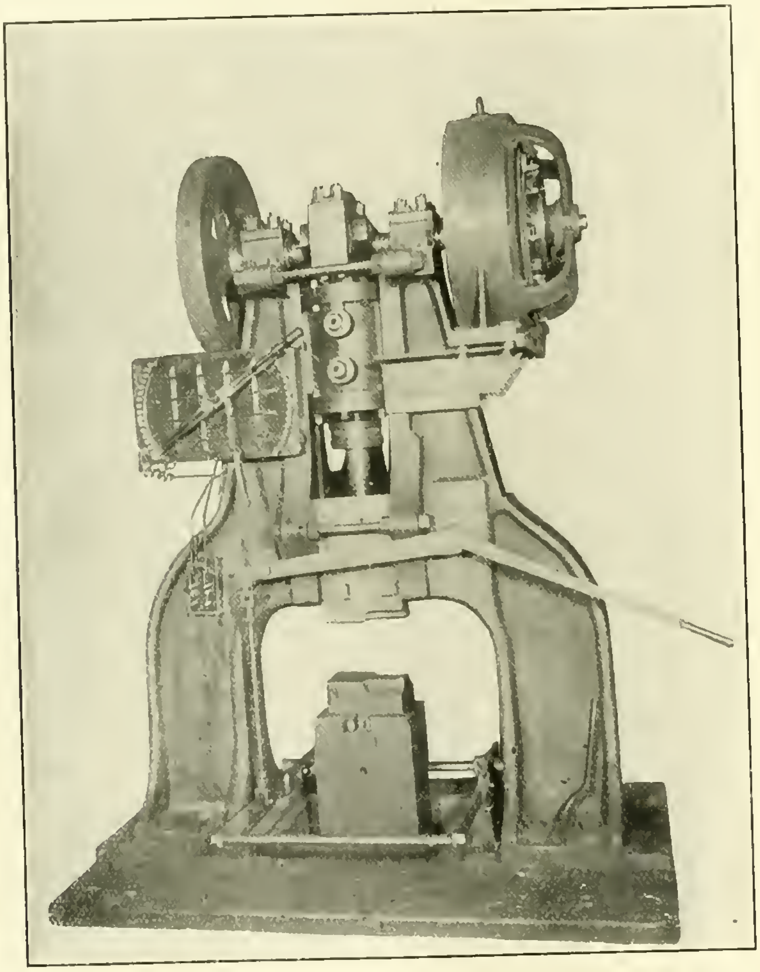
1. What is meant by the term specific heat? A.—1. Specific heat of a substance is the quantity of heat required to raise the temperature one degree Fahrenheit, compared with that required to raise the temperature of a quantity of water of equal weight one degree. The unit of heat is that which is required to raise the temperature of one pound of water one degree, from 32 degrees to 33 degrees Fahrenheit; and the specific heat of any body is expressed by the quantity of heat in units necessary to raise the temperature of one pound weight one degree. The specific heat of water is represented by 1. The specific heat of steel, for instance is about .117, so that it takes about 8½ times the quantity of heat to raise the temperature of water that is required to raise the temperature of steel. 2. What is latent heat? A.—2. Liquids, in the course of being transformed into vapor by heat, absorb a certain quantity of heat which remains latent in the vapor. That is, the amount of heat present cannot be found out by the thermometer. When the vapor is condensed back into liquid the whole amount of heat becomes sensible and is communicated to other bodies. Thus, if we take one pound of water at 32 degrees in a vessel that will hold the vapor at atmospheric pressure, and apply heat to it, the temperature will rise till 212 degrees, the boiling point, is reached. In doing this, 180 heat units have been put in the water. The application of heat is continued, boiling will go on, and 966 more heat units will be put into the water before it is all evaporated, but the heat will not show more than 212 degrees by the thermometer. The 966 heat units are called the latent heat of steam at atmospheric pressure.

Good locomotive engineers looking for jobs are getting scarce. We understand that many railroads are hiring engineers. Among those we have heard mentioned are the Chicago & Alton, the Queen & Crescent and the Wheeling & Lake Erie.

An Electric Power Hammer.

This is something of a novelty in the hammer line, in that it is operated by a direct-connected electric motor, making a compact combination, which is also said to be very economical.

It is always under complete control, so that light or heavy blows can be struck at will, and the motor is only in operation when hammer is in use. This saves the belt losses of a belt machine and condensation in the case of a steam hammer. As will be seen, it can be operated by the handle or treadle, and is a very solidly built tool. It is known as the Hackney



HACKNEY PNEUMATIC POWER HAMMER.

pneumatic hammer, the blow being cushioned by the air cylinder shown. The Wais & Roos Punch and Shear Company, Cincinnati, Ohio, are the manufacturers.

St. Paul and Duluth Shops.

At the St. Paul & Duluth Railroad shops they are very busy overhauling their freight car equipment, putting on M. C. B. couplers and New York air brakes. They are using Butler drawbar rigging and Kewanee brake beams. The air pipe through the freight repair yard for testing brakes, running air boring machines, etc., runs along close to the rail above ground. They have no trouble from freezing up, probably because the air is cooled and water trapped off before it gets into the pipe line. There is a unique snow fence along this repair yard, made of old freight car bodies. These boxes are also utilized as storerooms for material used in repair work.

Air hoists are used all over the shops and in the roundhouse. Air is used for cleaning out flues, and for the blower when lighting up the engines. In the engine house between a good many of the pits are located cranes, which come just right to lift an air pump or a steam dome cover.

In addition to this they use a portable crane made of a heavy piece of gas pipe. The base plate sets on the plank floor under the pilot beam outside the rail. Another plate slips over the gas pipe and comes against the bottom of the pilot beam. A screw jack is put in between these plates and holds the bottom one solid on the floor and the top one solid on the pilot beam. This portable derrick will lift off steam chest covers easily.

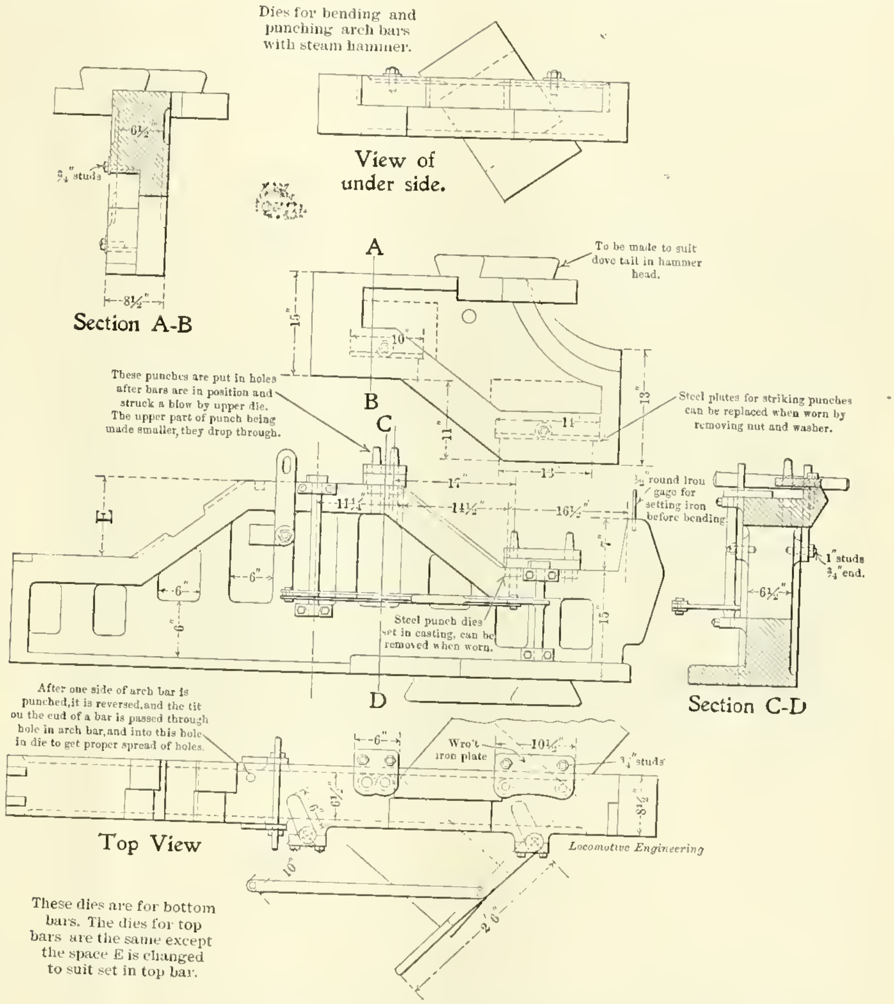
In the coach shop Mr. Brooke is using a "gilding wheel," which handles a paper tape with a strip of gold leaf on one side of it. The wheel is rolled along where the stripe of sizing comes and leaves the gold leaf. It is much more economical, both in material and time of workman.

For an air-brake man the instruction room designed by and in charge of George R. Parker is the most interesting exhibit in this Northern country. It has been illustrated in LOCOMOTIVE ENGINEERING, but a photograph does not do it justice, it is so complete in all its details and so well arranged to show all the operations of the automatic brake.

sheet of platinum without any ash, being the diamonds.

Bending Arch Bars on a Steam Hammer.

Master Mechanic Beckett, of the Louisville & Nashville road at New Decatur, Ala., has favored us with photographs and drawings of his method of bending arch



ARCH BAR FORMERS USED AT NEW DECATUR, ALA.

Diamonds in Steel.

It is well known that in the manufacture of carbon steel microscopic diamonds are formed, and the curious fact is stated by the *Scientific Press* that, from the examination of a number of steels from a variety of processes, identical results were given. A piece weighing 300 grams was cut from a lump of steel and treated with nitric acid, the insoluble residue collected being mainly graphitic carbon; after being washed with water, it was boiled three times with fuming nitric acid, which partially dissolved the residue—hydrofluoric acid and then fuming sulphuric being used—there then remaining nothing but graphite, which, after being washed, was melted with chlorate of potash. The insoluble residue obtained fell to the bottom of a vessel filled with iodide of methylene, the little transparent octahedrons visible through a microscope, which burned on a

bars, which was mentioned by our Mr. Conger in a recent issue

Fig. 1 shows upper die. The bars are bent on side *O* and punched on side *Y*; the punches are struck by plates *Z*, which are steel and set in casting, and can be removed when worn out. One-half of bar is bent and punched at a time.

In Fig. 2 the first die is for bottom bars, and second is for top bars. The bar lying on the die is in position for punching; it is bent on the front side and pushed over into position shown for punching—the die being 10 inches wide. Block *A* for holding punches is slipped over lugs *B* (seen on second die); punches are then put into holes in block *A* and struck by upper die. Punches are marked *C*. The wedge *D* is for holding bars in place while bending. *E* is a rod with a tit on the end which passes through the bar into a hole in die to give proper spacing for punching holes. *F* is a rod with a cam on end and a tit on under side to push arch bars over to punching position after bending. *G* on second die is an improvement on bar *F*. *H* is a stop gage for position of straight bars before bending.

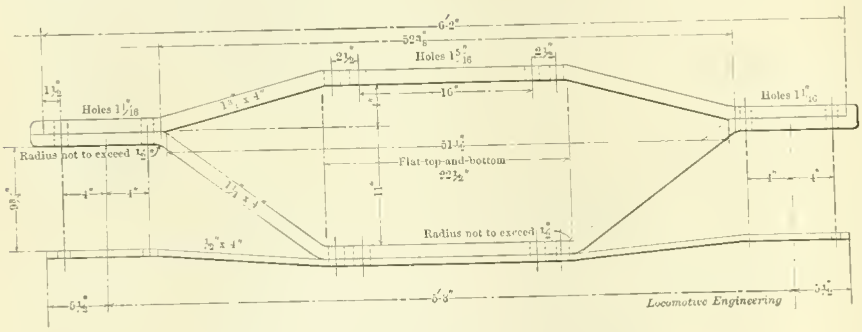
The die in Fig. 1 is attached to steam-hammer head, and in Fig. 2 to anvil block.

The Brick Arch.

I want to say a word about brick arches. I find that they burn more coal, in my humble opinion, than a clean firebox, and they kill a fireman in hot weather, using the clinker hook to keep coal in the space between the arch and flue sheet, whereas, without the arch he can fire systematically, and with half the labor that a brick arch requires. Without an arch the fire burns evenly, heating in a uniform manner every square inch of heating surface. With an arch, all the fire must be torn from its place and made to fill the 4 to 6-inch place left by the exhaust at every revolution. The heating is not general; the flues get it all, and the very places that should have the best of heat to get good circulation around the inside shell get only a minimum portion of the heat that the fireman is killing himself to maintain. I notice the fact, that the writers who favor the brick arch are engineers, and perhaps old men who were taken from the shops, or who were promoted during the "coffee-pot days," as the expression is here, and have never tackled one of those big consolidations on a July day with fifty to eighty "hoppers" behind him, and I say to him, "I congratulate you;" but if you want the merits of the case, question the fireman.

VERNARD L. EDMUNDS.

Petersburg, Va.



ARCH BAR FORMED UNDER STEAM HAMMER.

Nicknames of Railroads.

One of the characteristics of the American people is the abbreviation of proper names. The long names of railroad corporations are no exception to the rule; a majority of them are better known by their nicknames than by their proper legal ones. Some of these names are given them by enterprising passenger agents, others are the result of shortening for convenience.

For instance, the M., K. & T. is called the "Katy Line;" the St. L. & S. F. is the "Frisco," although it does not run anywhere near that famous city on the Pacific Coast. The Southern Pacific rejoices in the name of the "Sunset Route," while its nearest sister line, the Union Pacific, is called the "Pathfinder." The C. & N. W. is widely known as the "Northwestern," while its competitor, the C., M. & St. P., sports two nicknames—sometimes the "St. Paul," at others the "Milwaukee Road." The C., C., C. & St. L., part of which was at one time called the "Bee Line," is now dignified with the title of "Big Four," an allusion to the four large cities it joins together. The P., C., C. & St. L. is shortened up to the "Pan Handle," although just why cannot be made plain. The C., N. O. & T. P. is set off by the brilliant name of the "Queen & Crescent," a very good title for this jewel in Cincinnati's diadem.

What is now the "Wabash" was once the Toledo, Wabash & Western; the T., St. L. & K. C. is the "Clover Leaf." The L. S. & M. S. is shortened up into the "Lake Shore." At one time it was the M. S. & N. I., before it was joined by the C. & T. The C. G. W. is the "Maple Leaf," and around Kansas City the K. C., P. & G. is known as the "Pee Gee." That great system stretching from Chicago to the Coast—the A., T. & S. F.—has the name of an old city off at one side of the main line, which not one in a hundred of its patrons ever saw—Santa Fe. The G. T. R. of Canada is known as the "Trunk," and its lively business rival, the Canadian Pacific Railway, is reduced to the initials C. P. R.

No one has yet shortened the name of James Hill's line to any less than Great Northern; its full name won't stand much clipping. The M., S. Ste. M. & A. is very agreeably shortened into the "Soo Line," and large numbers of our railroads save time for their patrons by initialing, a custom of using the initials only, of which the B. & O. is an example.

The secretary of the Master Mechanics' Association announces that there will be two of the association's scholarships in Stevens Institute vacant in June next. There ought to be a crowd of candidates.

Locomotive Fire Lighters.

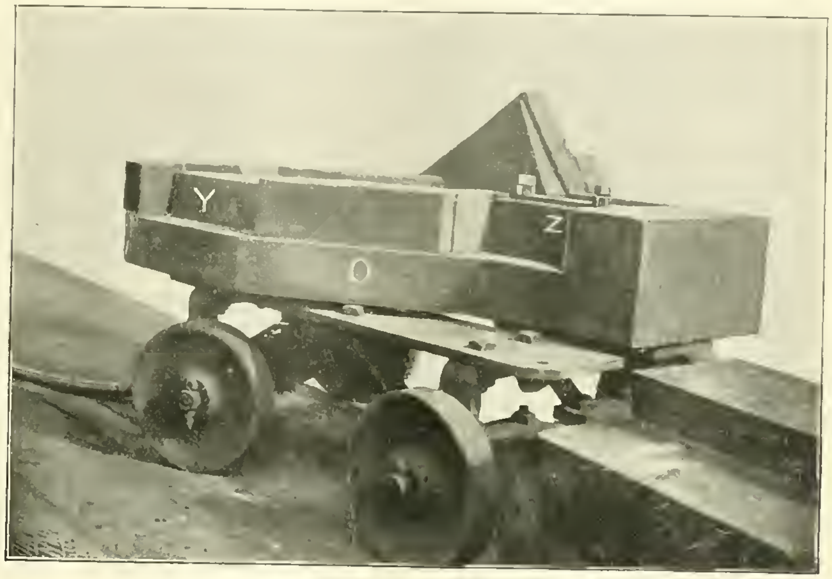
They have just installed the Leslie fire-lighting system in the Elmira roundhouse of the Lackawanna road, and it is giving good service. It is connected so hat fires can be lighted anywhere, the oil and air pipes being dropped from the roof between the stalls.

This makes a neat and quick way of firing up, as it only takes from six to nine minutes to get the fire started, the time depending somewhat on the kind of coal. About 3 gallons of oil are used for each fire, making the fuel cost not over 6 cents.

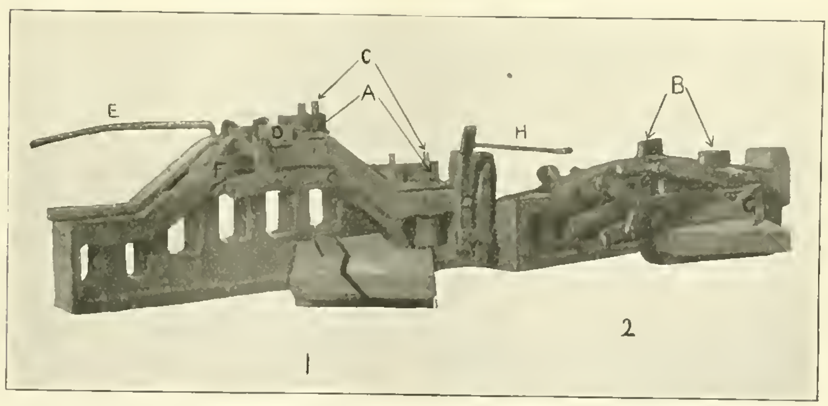
There is also a steam pipe connection, so that the blower in the smoke arch is operated until the fire gets thoroughly started. A pipe for this runs along each pit and is connected by hose to a "T" or blower pipe, just outside the arch.

A large pipe also supplies steam to every stall, so that a Little Giant boiler washer and tester can be used at any point, water connection being also brought up through floor at the right place.

The whole thing is very nicely planned and is convenient for all the purposes it is intended. The only objection to this and other similar plans is, that in carrying the steam so far from boiler to tester, the injector end of the machine may find the steam too wet for best results. Wet steam is bad for any injector, and is particularly dangerous for one which must force against pressures so much greater than the initial steam.



BECKERT'S ARCH BAR FORMER FOR STEAM HAMMER.



ARCH BAR FORMING DIES USED BY MASTER MECHANIC BECKERT AT NEW DECATUR, ALA.

A modern, up-to-date fence which seems to be free from all objections, and which has many good points of its own, is the Hartman steel rod picket fence, manufactured by the Hartman Manufacturing Company, of Ellwood City, Pa. It is strong, durable and long-lived, and when accompanied with their ornamental steel gates, adds very materially to the beauty of an enclosure. The cost is low, when you take into account the beauty and utility of the fence.

The New York Air Compressor Company report sales of over ten air compressors in as many days. These include a large duplex compressor for Japan and four compressors of 1,200 cubic feet capacity for the Pennsylvania Railroad.

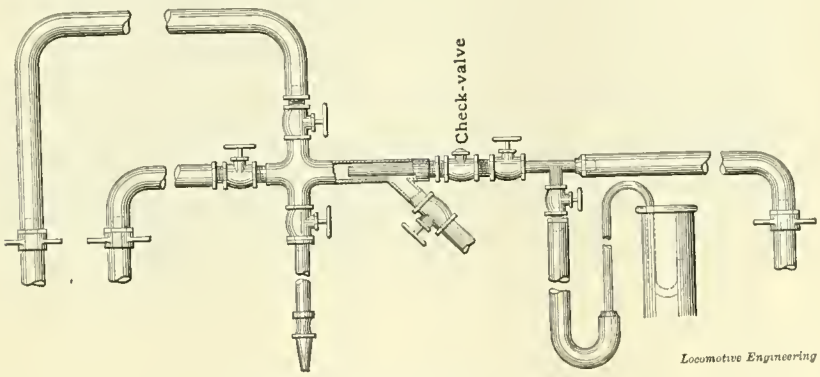
The Rossell Boiler Washer and Filler.

In describing this, Mr. Rossell says:

"When steam is blown off engine that is to have her boiler washed, the instrument is connected to feed pipes of both injectors, and to injector of live engine plugs are pulled out of engine to be washed. The instrument is started by putting the two injectors of dead engine on heater, but opening valves wide. Water from house supply is started; injector on live engine is put on heater, and steam is blown back, heating the water and forcing it into dead engine through both checks, both steam pipes to injectors, and if engine has a mud drum a hose can be connected to it or to the blow-off cock, or a nozzle can be connected to this hose and entered into one of the plug holes. This makes five streams of hot water entering boiler as water is leaving, causing a rapid circulation, not allowing the sediment to settle and bake on tubes, crown-sheet, etc. In washing boiler legs two hose can be used, one each side, or, if boiler is very dirty a ½-inch pipe can be connected to steam line and entered into plug-hole wherever mud is the thickest, stirring it up for the water to wash it out. Two engines can be washed with this instrument at the same time, or one after being washed, can be filling while the other is washing, or the two engines can be filling together at the rate of about 75 to 90 gallons per minute, according to size of injectors; but what is lost in quantity is gained in heat-units. After enough water is in boilers, the water is shut off, letting steam flow into boiler, and the fire is started. In a few minutes the blower can be used, as the engine soon commences to make steam, or the stack blower can be used, as shown in cut of instrument. With this instrument and my flue-cleaning device a standard engine can have her boiler washed, flues cleaned (as clean as when first put in boiler), boiler filled, new arch if necessary, a good fire ready to go out to her train, in one hour and thirty minutes or less; a consolidated in two hours or less. In case of a very dirty boiler it might take a little longer. If it is a case that work has to be done in front end, two gages of boiling water can be put in and 120 or 130 pounds of steam before starting the fire. When front end is closed fire can be started, and in about twenty or thirty minutes engine is fit to go on her train.

"In filling cold boilers with this instrument all parts are heated equally before the fire is started, causing an equal expansion, and if used there will be no more excuse for allowing sediment to remain in boilers, and with my flue-cleaning device flues can be cleaned with the fire in or dumped, at the rate of six to ten per minute. In getting up this system a great part of my study was to complete it as near as possible with the material found in railroad storerooms. This I have done, with the exception of two fittings that will cost about $2.50."

For further information address Mr. Thos. J. Rossell, New Haven, Conn.



ROSSELL'S BOILER WASHER AND FILLER.

Baby Ran the Locomotive.

"I can run an engine like papa," said little three-year-old Fred Evans, as he was lifted down from the locomotive of the St. Johns motor line yesterday at Albina, says the *Oregonian*. He had mounted the engine at St. Johns, pulled open the throttle and remained on the seat alone on a mad ride of seven miles. The young engineer is the son of W. B. Evans, of St. Johns, an engineer on the motor line. He had often been on the engine, and his father had explained to him how the lever is pulled and the wheels started moving.

The engine lies over an hour at St. Johns, just by the water tank, and during this time yesterday, while Mr. Evans was at home at lunch, little Fred walked down to the engine, mounted the seat and opened the throttle wide. The machine was full of coal and water, and was ready for the road. Several people saw the boy start, but no one was near enough to catch the engine. The news was at once told to Mr. Evans, and he reached the track just in time to see the locomotive, with his boy on board, disappear around a curve. The father was wild with grief and fear, and the boy's mother was almost prostrated.

The news spread like wildfire, and the whole town turned out. Excitement was intense, women and children cried and men offered suggestions. Master Mechanic Michael F. Brady was at that end of the line and at once began to telephone to stations along the line. Portsmouth and Peninsular were notified, and men at th se points tried to board the engine as it dashed by, but its speed was too great. Mr. Brady also notified the office at Albina, and a party of men ran out the line northward to meet the wild engine. In coming up the long grade toward Albina the steam had died down a little, but the register still showed 80 pounds. John Woods, a motorman on the City & Suburban Railway, was the first man to meet the engine. He caught the hand rail and swung up, but in doing so he was dragged 60 or 75 feet. He at once turned off the steam, and the engine slowed down and stopped. It was then young Fred made the remark concerning his ability as an engine driver.

The boy was not scared at all, but seemed rather proud of his feat. When the engine first dashed out of St. Johns he was frightened, and as he came through Portsmouth like a shot out of a gun, he was yelling lustily for "mama." After coming several miles, however, he again became brave and held his position on the seat with composure, with his hand on the lever, like a veteran.

The engine was stopped in front of the home of Dr. Davis, on Commercial street, and was quickly run back to St. Johns by Mr. Woods, with the boy Fred still on board. Mr. Woods said his success in boarding the engine was a surprise to him, as well as everyone else, as its speed was still considerable. The engine had made the run from St. Johns to Albina in less than half an hour.

In the meantime the news of the rescue had been sent by telephone to the frightened parents, and for the remainder of the day there was great joy in all St. Johns.

Grinding a Valve Seat.

In old times when valve seats and cylinder castings were made of the hardest kind of iron, some of the seats were so hard that it was a two days' job to face one; a file would hardly touch one of them. A few of those old engines are still in service, and while their seats do not wear very fast, yet they have to be faced once in a while.

One of these jobs was turned over to a young machinist, who took a pig of lead to the steam hammer, cut it in two pieces and hammered them out into blocks long enough to cover the entire seat. Then with emery and turpentine he ground the seats down true in a day, by hand. The sharp particles of emery bedded themselves into the lead and made a very good cutting machine, which was heavy enough to feed itself down to its work, and the block was thick enough to retain its correct flat surface.

I Wish I Was an Engineer.

I wish I was an engineer. I guess I'd like to stand
In the cabin of an engine with a dingus in my hand,
And when I'd pull that thingumbob the engine then would go
Out, out into the nighttime when the stars is hangin' low,
And I'd see the lights of houses go gleamin', gleamin' past,
Like a last-campaign percession when it's walkin' middlin' fast;
And then I'd pull the whistle-string an' hear the engine say:
"Hey, there! you little mites of men, you'd better clear the way!"
I wouldn't mind just loads of black upon my face and clothes
If I could be an engineer, the land o' goodness knows.

I wish I was an engineer. Then boys would look at me
And say: "Hey, Jimmy, here's de chap wot runs de engine. See!"
And then I'd pull the whistle string an' never smile a bit
When that big noise would scare the boys almost into a fit,
Because I'd know, as engineers, I guess, 'most always do,
That if a noise scares little boys, they're apt to like it, too.
Just whistlin' through a hundred towns, straight onward hour by hour,
While all the time the ceaseless "chug" beats out the Song of Power,
Oh, you will talk admirin' of your Kings and Czars, maybe—
To be an engineer, you bet! were good enough for me.

I wish I was an engineer, to sit there like a Turk
And smile to see the fireman sweat while doin' of the work.
I s'pose that Emp'rors has a snap, to which, of course, they're born,
But if I was an engineer I'd look on them with scorn.
Just sittin' in my cab up there and listenin' all the time
Unto the constant "chug-chug-chug," that ceaseless, mighty rhyme,
And knowin' that a hundred lives was trusted unto me,
I guess I'd feel a sense of power; I'd catch the music's key
And hear it singin' in my soul as down the world I'd go,
If I were but an engineer—but, then, I ain't, you know.

—A. J. WATERHOUSE.

"Electric Wiring." By Cecil P. Poole. Published by the Power Publishing Company, New York. $1.

The author, who is well known in electrical fields, has evidently given much time and thought to this little book. It makes the mysteries of electric wiring clear to the beginner and at the same time it is a valuable book of reference for engineers, as the formulas and tables are in convenient shape for ready use. Wiring tables for alternating current motors are also given, and as this has been more or less of an unknown quantity to many of us, they will be appreciated. Tables showing the corrected drop in inductive circuits are also shown, and should prove of value. It is nicely bound in leather, with round corners so as to fit the pocket.

Moving Chicago Pneumatic Tool Works.

The moving of the St. Louis works of the Chicago Pneumatic Tool Company from St. Louis to Detroit is causing quite a stir in Detroit, as there are absolutely no vacant houses suitable for the habitation of workingmen, and where the multitude of employees who accompany this factory will be housed is a problem that the landholders and real estate men are trying to solve. The site of the new location is at the corner of Second avenue and Amsterdam street. The employés will be brought to Detroit by special trains, and a plan to meet them with a brass band and have a parade is being discussed by Detroiters, but it is rather doubtful where to take the procession unless the house builders of Detroit do some tall hustling between now and June. The Chicago Pneumatic Tool Company, who manufacture tools for all purposes run by compressed air, have another large factory at Philadelphia. The Detroit people are very fortunate in securing this industry, as it is one of the most rapidly growing industries in the country to-day.

An improved appliance for delivering mail pouches from fast trains has been patented by Harry F. Kelleam, an apprentice in the Chicago & Northwestern Railway shops at Clinton, Iowa. The apparatus consists of a hinged frame or trap set in the floor of the car just at the doorway. Beneath the frame and under the car is a vertical cylinder operated by compressed air, the piston of which is fastened to the frame. To throw the mail pouches from the car the messenger opens the air valve and the piston raises the trap which is hinged at the door side. By this apparatus the pouches may be thrown almost any distance from the car. The idea is to throw mail of any quantity from the car without necessitating a slow down or stop, and also to throw the sacks such a distance from fast trains that they will not be drawn under the wheels by the strong undercurrent of air generated by the rapid motion of the train.

Raise of Pay.

The following circular was recently issued by Mr. G. S. MacKinnon, master mechanic of the Canadian Pacific at Toronto Junction:

"Commencing to-morrow, February 1, 1900, we will allow engineers 25 cents and firemen 35 cents per 100 miles on Mastodon, Decapod and Consolidation *road* engines on this division; also we are increasing detention rate after schedule time to 29 cents for engineers and 18 cents per hour for firemen. You all, of course, know the enginemen's schedules do not expire on this division for some sixteen months yet, but we are not taking advantage of that fact, as this advice plainly shows. I trust that engineers and firemen will take more interest in their work than some have in the past, and keep these locomotives in best of condition in every way."

"Break-Downs and Their Cures" is the name of a new book by Donald R. MacBain, Jackson, Mich., just received. It is a small book of 124 pages, convenient for the pocket, and is sold for 50 cents. It tells in simple language how to deal in the easiest way with the most common form of break-downs to locomotive, and tells a good many other useful things which the engineer and fireman ought to know. It will prove a useful addition to the growing literature of the cab.

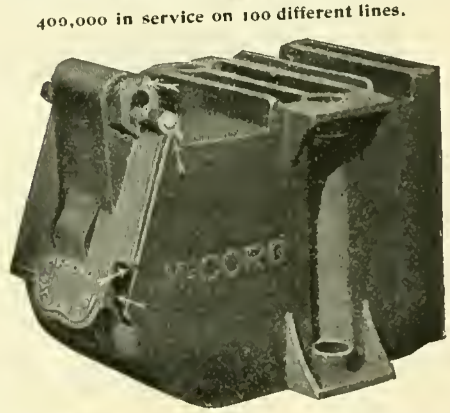
On the Southern Pacific Railway they are using, at the Kern City roundhouse a friable stone called decomposed granite, for floors. This stone is easily crushed fine by pounding into place; it is then oiled with the heavy grade of fuel oil found in this country, which makes the top smooth, a little elastic and both dustless and waterproof. From the appearance of these floors, we think that all broken-stone floors will be improved by a coating of oil after the floor is laid.

We have received a letter from the Brooks Locomotive Works which says: "We notice in the March issue of LOCOMOTIVE ENGINEERING an article on 'Anti-Bandit Attachment' on Denver & Rio Grande engines. While we do not vouch for the statement made in the clipping referred to, we beg to inform you that, at the request of the Denver & Rio Grande officials, pipes for this purpose were applied to the ten locomotives built by us for that road last October."

The little booklet recently issued by the Crescent Steel Company, showing articles from their exhibit at the National Export Exposition, gives some of the most remarkable examples of durability we have ever seen. It is very interesting to any mechanic.

The Baltimore & Lehigh Railway is to be made standard gage, and will be in operation by the 1st of July. They have ordered five ten-wheel engines from the Richmond Locomotive Works. They are to have 19 x 24-inch cylinders, with 60-inch drivers, and will weigh about 60 tons.

Catalogue 16 of the L. S. Starrett Company, Athol, Mass., contains about as interesting an assortment of fine tools as a mechanic wishes to see. There are several new tools and improvements on old ones, which are all desirable and will find places in the kit of the first-class shop man. Machinists who want to keep their tool-box up to date will send for a copy.



A remarkably handsome illustrated catalogue has been published by the Gould Coupler Company, New York, showing the various appliances manufactured by the company. The work covers 110 pages of the Master Car Builders' largest standard size, and is got out in the very finest style of printing and engraving. We think that many railroad officials who are in the habit of doing business with the Gould Coupler Company will be surprised at the extent of the merchandise they handle. We will not attempt making a list, but advise those interested to send for the catalogue.

Messrs. W. H. Paterson and McCord & Co. have secured control of the Illinois Car and Equipment Company, of Chicago, and the McCord specialties will hereafter be manufactured by them. The report that McCord & Co. are to assume the management of the car company is not correct, but probably arose from the officers of the two companies being nearly identical. For the present the work will be confined to forgings, castings and wooden cars.

The Philadelphia Pneumatic Tool Company send us several interesting circulars of their tools. They are now handling the output of the Keller Tool Company and putting out new Keller tools. Their pneumatic rammer for foundries is a new device which is sure to attract attention as a saver of time and hard work.

The steel rod picket fence of the Hartford Manufacturing Company is fully illustrated in their new catalogue. It is well adapted to railroad use, and seems to be particularly attractive around stations. Catalogue can be had from Room 4, 309 Broadway, New York.

A. O. Norton, manufacturer of ball-bearing lifting jacks, Boston, Mass., and Coaticook, Quebec, Canada, has built a 75 x 35-foot two-story addition to his Canadian plant, and reports enough orders already booked to keep both plants employed to the maximum of their capacity until April.

The Lehigh Valley Railroad has made it a custom for some years of having passenger representatives located at New York city meet all incoming passenger steamers from European ports, and also passengers arriving by its trains, who are going abroad; and in fact attend to all business in connection with arranging for hotel accommodations, sleeping or parlor car tickets and the checking of baggage, etc., that is necessary for passengers destined to points beyond New York via the Lehigh Valley line, or the transfer to steamers of passengers and baggage, looking after steamship accommodations, etc.

During the year 1899 the Baldwin Locomotive Works built locomotives for nineteen different rail gages. They were 1 foot 7½ inches, 1 foot 9½ inches, 1 foot 11⅝ inches, 2 feet, 2 feet 6 inches, 2 feet 6 1-10 inches, 2 feet 11 inches, 2 feet 11½ inches, 3 feet, 3 feet 3 inches, 3 feet 3⅜ inches, 3 feet 6 inches, 3 feet 8 inches, 4 feet, 4 feet 8½ inches, 4 feet 9 inches, 4 feet 9⅛ inches, 5 feet, 5 feet 6 inches.

France has fallen into line with the countries using the "continuous" or 24-hour day. It has been adopted in all her official departments. The English-speaking countries have opposed this, as they are opposing the metric system, but it has arguments in its favor that are all its own.

"Facts Proven" is the name of a small folder recently issued by the International Correspondence Schools, Scranton, Pa. It gives a few more facts to prove that a course in the school is one of the best investments that an ambitious man can make.

At San Bernardino, on the Southern California Railway, they are making their own axles and heating the pile of scrap in an oil furnace. It has been stated that an oil furnace would not give good results, but the appearance of the forgings shows that fuel oil can be used for this purpose successfully.

The hose splicing device used in connection with the hose stripper of Buker & Carr has met with such favor that they are behind with their orders. They are now being taken for future delivery, but can hardly be reached under ninety days.

The Chesapeake & Ohio people are putting ruberoid covering on the roof of their cabs, and they find the material the most satisfactory of anything they have ever used. It is a good non-conductor, and so keeps the roof cool, and it is not affected by acid or other corroding influence.

Newspaper reports say that the Philadelphia & Reading people have decided to erect a plant near Reading for the building of new locomotives. The capacity, they say, will be 100 locomotives a year. This is important if true, and if the scheme is real we would say—don't.

An officer of the Paris Exposition, who recently made a trip from New York to Chicago on the New York Central's "Lake Shore Limited," gave to the dining car conductor his card, on the back of which was written these ten significant words: "The best dinner I ever had on a dining car."

CONTENTS.

Locomotive Engineering

Copyright, 1900.

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII — 95 Liberty Street, New York, May, 1900 — No. 5

Norfolk & Western Freight Engines.

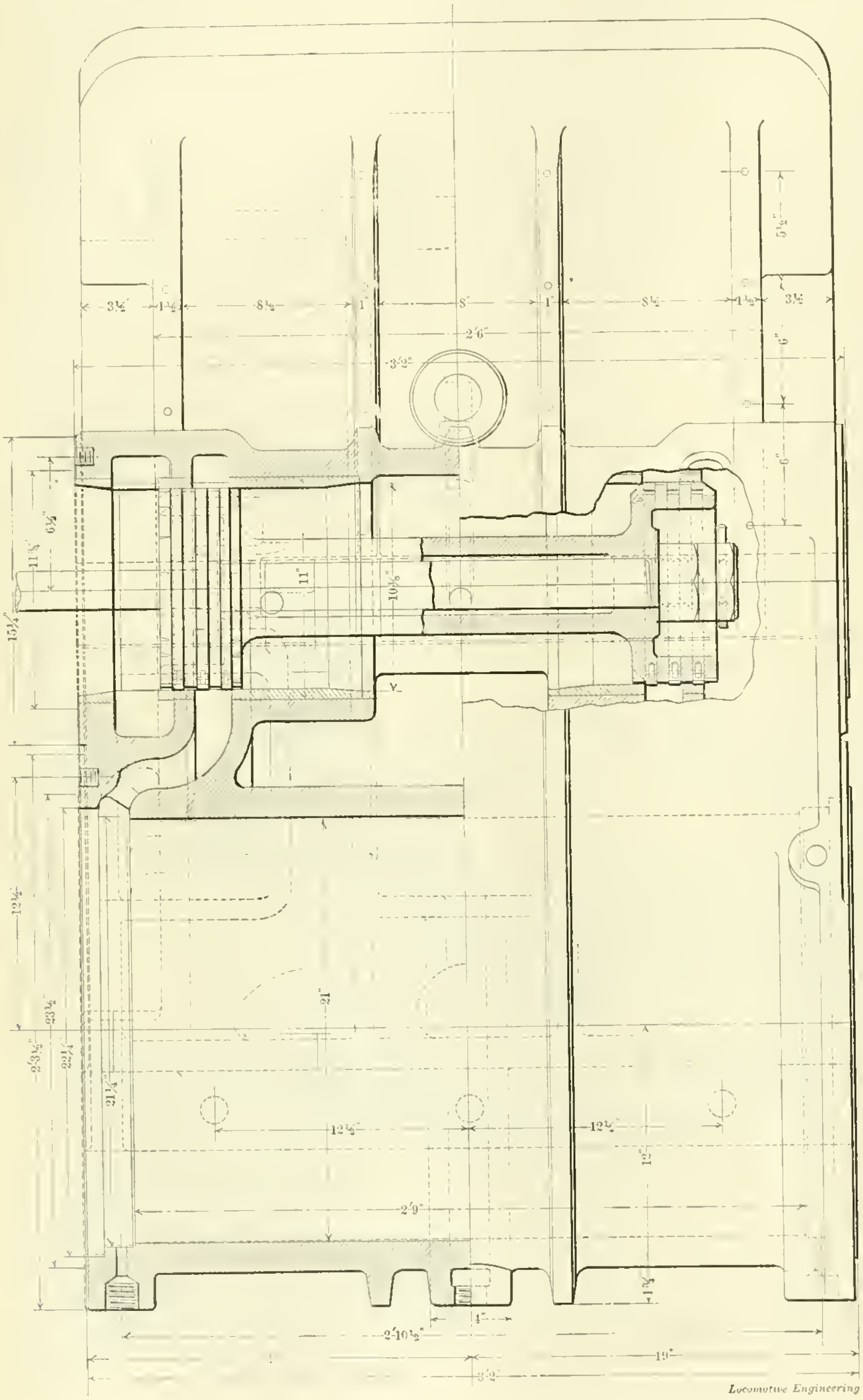
During a recent visit to the Norfolk & Western shops at Roanoke, Va., we found them very full of work, Mr. J. E. Battye, assistant superintendent of motive power, in charge of the shops, having all he could do to meet the demands put upon the capacity of the shops. Besides doing the work of keeping up 450 engines, they are building in the shops two engines per month of the kind illustrated in the annexed engraving. These engines were designed by Mr. W. H. Lewis, superintendent of motive power, for the purpose of hauling a train of 1,000 tons over the Blue Ridge Mountains, the maximum grade being 66 feet to the mile. The engines have demonstrated their ability to do this with ease, and on a special trial have pulled 1,135 tons over that portion of the road and 2,430 tons on the Norfolk division, where the maximum grades are 37 feet to the mile, but are so located as to receive the benefit of the momentum of the train.

While the engines built at the Roanoke shop, with the piston valve, have only been in service a short time, still the use of the piston valve is not experimental, as they have a number of the engines with the piston valves, some of which have been in service nearly three years, and the performance of these valves has been entirely satisfactory. The distinctive feature of this valve is the center admission of steam, which in a measure serves as a steam jacket to the steam passages of the cylinder, and as the pressure of steam is removed from the valve stem stuffing boxes, the exhaust only coming in contact with it removes the necessity of accurately fitting the valve stem packing and the frequent annoyance of valve stems blowing, as with the old form of end admission. It also insures perfectly balanced valve, as it has been demonstrated that the valve can readily be removed by hand pressure with the valve stems disconnected, and this is a very important feature, as it eliminates the internal friction incident to the slide valve, and a consequent increase in the power of the engine.

LATEST NORFOLK & WESTERN FREIGHT ENGINE.

Some of the engines of this class, built by the Baldwin Locomotive Works, with the slide valves, have not been in service more than one year and have rendered most excellent service, and their performance thus far has not indicated that the slightest change from the original plans would be desirable.

slide valve. The steam from the steam chest enters between the valve heads. Admission to the front steam port is opened when the valve is moving forward, and to the back port when it is moving backward. The valves and eccentrics have, of course, to be set to meet these conditions.



CYLINDERS OF NORFOLK & WESTERN ENGINE.

The cylinder and valve arrangements are shown by line cuts on this and the next page. We frequently have inquiries about the setting of piston valves, a matter that is made quite clear by this engraving. It will be seen that the steam is admitted the reverse way to which it let into the ports with a

Coal Derrick.

The Southern Pacific Company use a good many movable derricks for hoisting coal on tenders where the coal is stored in a long pile on the ground. These derricks are set on a small platform car carried on four wheels for standard gage track, so they can be moved around the yard with no more trouble or work than a section man's push car when loaded. This derrick has a long air cylinder fastened along the boom, which lifts a half-ton bucket with ease. To balance the bucket of coal so the derrick will not tip over, a heavy air reservoir of cast iron is set on the other side of the center and swings around with the boom. The reservoir has an air hose connection with the air supply pipe running through the coal yard.

Movable derricks are about the only machine that will handle coal from a long bin on the ground, and these little machines do the work at a good speed with small expense.

Why the Pump Stopped Working.

Our friend A. J. O'Hara, of Port Jervis, N. Y., is packed full of railroad reminiscences. Here is one of the latest that leaked out of his stock.

The story is told by Uncle Ben Gardner, who has run the Honesdale branch train on the Erie for the past thirty years, that when he ran on a road away back in the sixties on one of the Southern lines, an engineer was running along one day and found his water was getting low in the boiler. He tested his pump by opening his pet cock. In those days injectors were not used very extensively. He found his pump would not work, so he stopped to find out what was the matter.

A man and his little boy happened to be standing close by where the engine stopped. The engineer went to take off the water hose to examine the strainer. In the meantime the little boy spoke up and said, "Pa, I always thought there were four small wheels in front of all engines." His father replied, "There are, but this engine has lost one." The fireman heard the conversation and looked towards the engine truck and saw that one of the wheels was gone. He hurried back and reported the fact to the engineer. "Of course it is," said the engineer; "what do you suppose I stopped for?"

The facts in the case were that the truck wheel broke off and struck the lug on the crosshead, where the pump plunger was connected, and broke it off, and of course stopped the pump; but the engineer did not find out until the boy discovered it.

"A System of Engines" is the title of the finest engine catalogue it has been our fortune to see. In fact, to call it a catalogue hardly does it justice, as it is an edition-de-luxe, with deckle edges, leather binding and illuminated pages. It shows the engines built by the Harrisburg Foundry & Machine Company, of Harrisburg, Pa., for different classes of service, and is almost a treatise on the subject of proper engine selection, as far as its hundred or more pages will allow.

Treating Railroad Ties and Timber.

At Los Vegas, New Mexico, the Atchison, Topeka & Santa Fé Railway have a pickling plant for treating ties and timber by the Wellhouse system, which has been in successful operation for some ten or twelve years. About 2,600 ties can be treated each twenty-four hours, or a like bulk of timber or piles. We will not speak of the chemical operations, but describe the mechanical ones at this plant.

There are three long boiler plate cylinders about 110 feet long and 6 feet in diameter inside, which stand a working pressure of 100 pounds per inch. The head of the cylinder is easily unfastened and swung to one side to admit small iron cars, which run in and out along a railway on the bottom. Twenty-five ties are piled on each car in such a shaped load that they fill the bore of the cylinder; the three cylinders hold thirty-nine of these cars.

When the cylinder is full and the head fastened on, connection is made to a powerful air pump which produces a partial vacuum of about 10 inches. This opens the pores of the wood and brings out some of the sap and moisture. Next, dry steam is turned into the cylinder and held at a pressure of 100 pounds for about two and one-half hours; this works into all the pores of the wood and dries out the ties. The air pump is again connected and a vacuum of 21 inches is maintained for some time; this brings all the moisture out of the pores of the wood. The moisture runs down to the bottom of the cylinder and is drained away before the next part of the process. This sap and moisture is what assists decay when left in the wood.

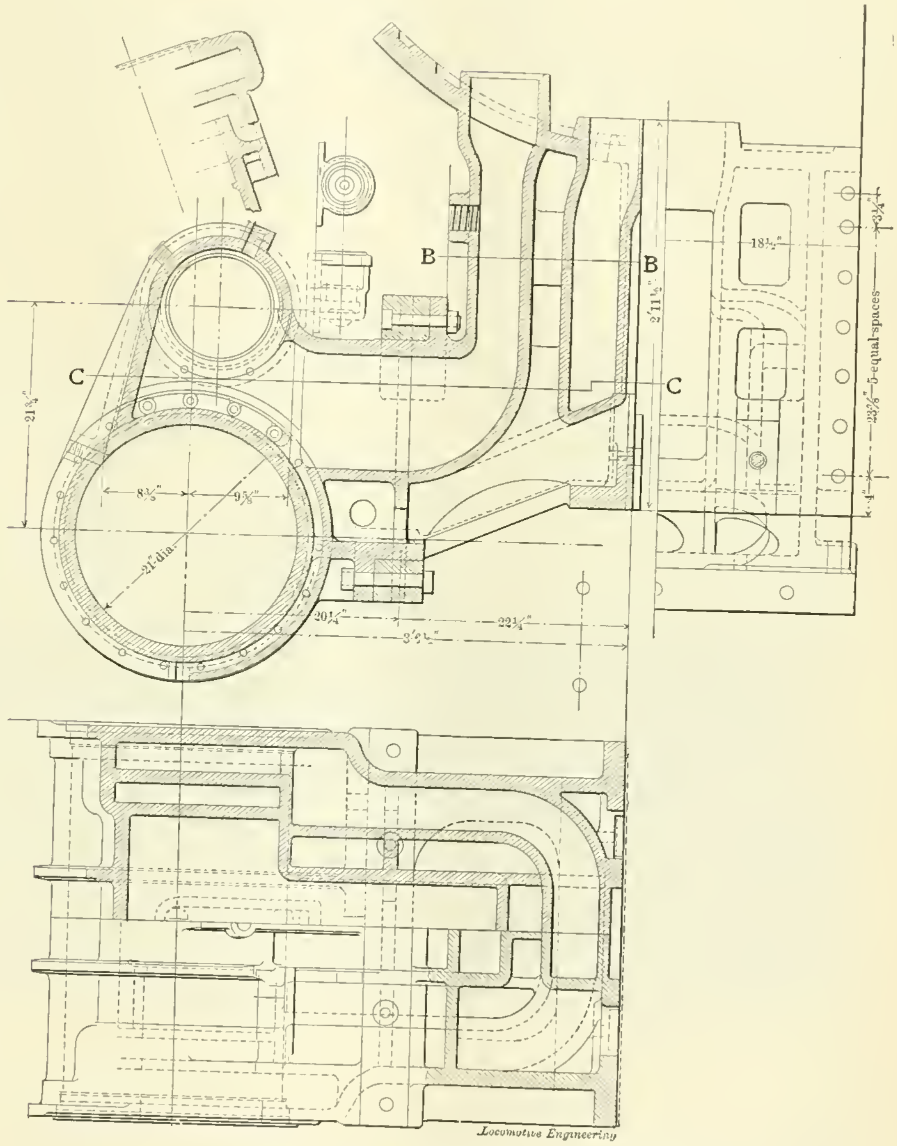
A strong solution of chloride of zinc and glue is then turned into the cylinder till it is full, covering all the ties, and 100 pounds pressure held on for about one and one-half hours. This pressure forces the solution into the wood and fills all the pores which have been opened by the previous steaming and vacuum process. The wood thus takes up a much larger quantity of the solution than with an ordinary soaking under atmospheric pressure, and it also works into the center of the tie.

Next, the chloride of zinc solution is forced out of the cylinder up into the storage tubs by compressed air, and a strong solution of tannin or hemlock extract turned in and a pressure of 100 pounds applied for about an hour, which finishes the process of filling the pores of the wood with the solutions. The cylinders are then emptied of extract; the ties allowed to drain for a little while; the cylinder head opened; the ties run out, and a new lot at once run in. Three lots are treated each twenty-four hours. When the ties come out and dry off, they are very hard, and so heavy that they weigh more than a hardwood tie. They are also in a degree fireproof, an advantage with bridge timber.

Pine ties are about the only ones treated. Ordinary pine ties would be used up in less than three years, even with tie-plates applied. After treatment their life is over ten years. The treated ties will not cut through as quickly where the rail rests on them, as they are very hard.

Two large boilers, 16 feet long and 6 feet in diameter, furnish steam for the large cylinders, the air compressor for the compressed air and the large air pump for maintaining the vacuum in the cylinders to draw the sap and moisture from the timber. A very large surface condenser comes between the cylinders and the air pump.

The water which flows through the tubes of the surface condenser, and around the air cylinder of the compressor, flows into a large underground cistern of cement. The exhaust steam from both air pumps passes through a coil of 4-inch pipe in this cistern and is also condensed, so there is a supply of hot water for the boilers, part of it condensed water. The cylinders are charged with steam alternately, so as to have a steady draft from the boilers. The various operations of filling the cylinders with ties, steaming them, forcing the solution into the wood, come along in a regular succession in each of the three cylinders, so that only one of them is open at a time. There are two other plants on the Santa Fé route, and all the ties and timber used on the west end of the system are treated.



CYLINDERS OF NORFOLK & WESTERN ENGINE.

Putting Pipes Out of Sight.

The new class H-6 (consolidations) of the Pennsylvania Railroad are without a single pipe outside the jacket in front of the cab. Mr. Vogt has recently put the Leach sander pipes under the jacket as well as the rest. This has the advantage of keeping the air warm and dry, and avoids the moisture, which is never an improvement.

Mr. Harry A. Norton, of Boston, is making an extended trip to Mexico and the Pacific Coast in the interest of the Norton ball bearing jacks, and reports business unusually good.

New York Central Mogul.

The mogul engine shown in our illustration is the latest freight engine put in service by the New York Central Railroad Company. It was designed by Mr. A. M. Waitt, superintendent of motive power and rolling stock, and built by the Schenectady Locomotive Works.

About ten years ago the New York Central people put into service mogul engines, designed by Mr. William Buchanan, that had cylinders 19 x 24 inches and developed about 22,000 pounds tractive power. These engines have done remarkably good service and haul trains of fifty cars and over, but the car loads have been increasing so rapidly of late years that it was considered necessary to have a freight engine with greater margin of power, and the engine shown is the result. It develops a tractive power of about 32,000 pounds. We understand that in service these engines are giving very great satisfaction, as might have been expected. The following are a few of the leading dimensions:

Weight in working order—155,200 pounds.

Weight on drivers—135,500 pounds.

Wheel-base—Driving, 15 feet 2 inches; rigid, 15 feet 2 inches; total, 23 feet 3 inches.

Cylinders:

Diameter of cylinders—20 inches.

Stroke of piston—28 inches.

Horizontal thickness of piston—4½ and 5 inches.

Diameter of piston rod—3⅜ inches.

Kind of piston packing—Cast-iron rings.

Kind of piston rod packing—U. S. Metallic.

Size of steam ports—18 x 1¼ inches.

Size of exhaust ports—18 x 2¾ inches.

Size of bridges—1⅛ inches.

Valves:

Kind of slide valves—Richardson balanced.

Greatest travel of slide valves—5½ inches.

Outside lap of slide valves—⅞ inch.

Inside lap of slide valves—Clearance, 1-128 inch.

Lead of valves in full gear—1-32 inch negative lead full gear forward; 3-32 inch negative lead full gear back.

Kind of valve stem packing—U. S. Metallic.

Wheels, etc.:

Diameter of driving wheels outside of tire—57 inches.

Material of driving wheel centers—Cast steel.

Tire held by—Shrinkage.

Driving-box material—Gun metal.

Diameter and length of driving journals—9 inches diameter by 12 inches.

Diameter and length of main crank-pin journals (main side, 6¾ x 5¼ inches)—6 inches diameter by 6 inches.

Diameter and length of side rod crank pin journals—Back, 5 x 3¾ inches; front, 5 inches diameter by 3⅝ inches.

Engine truck, kind—Two-wheel, swing bolster.

Engine truck journals—6¼ inches diameter by 10 inches.

Boiler:

Style—Extended wagon top.

Outside diameter of first ring—67 5-16 inches.

Working pressure—190 pounds.

Material of barrel and outside of firebox—Steel.

Thickness of plates in barrel and outside of firebox—21-32, ¾, ½ and 11-16 inch.

Horizontal seams—Butt joint sextuple riveted, with welt strip inside and outside.

Circumferential seams—Double riveted.

Firebox, length—108 1-16 inches.

Firebox, width—40⅜ inches.

Firebox, depth—F., 82 21-32 inches.; B., 70 21-32 inches.

Firebox, material—Steel.

Firebox plates, thickness—Sides, 5-16 inch; back, ⅜ inch; crown, ⅜ inch; tube sheet, 9-16 inch.

Firebox, water space—Front, 4 inches; sides, 3½ inches; back, 3½ inches.

Firebox, crown staying—Radial stays, 1⅛ inches diameter.

Firebox, staybolts—Taylor iron, 1 inch diameter.

Tubes, material—Charcoal iron No. 11.

Tubes, number of—366.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—12 feet 2½ inches.

Firebrick, supported on—Studs.

Heating surface—Tubes, 2,321.6 square feet; firebox, 185.6 square feet; total, 2,507.2 square feet.

Grate surface—30.3 square feet.

Smokestack, inside diameter—16 inches at choke, 18½ inches at top.

Smokestack top above rail—14 feet 6½ inches.

Boiler supplied by—Two Monitor injectors, No. 10.

Tender:

Weight, empty—44,700 pounds.

Journals, diameter and length—5 inches diameter by 9 inches.

Wheel-base—16 feet 6½ inches.

Water capacity—5,000 U. S. gallons.

NEW YORK CENTRAL'S IMPROVED MOGUL.

Coal capacity—10 tons.

Total wheel-base of engine and tender—50 feet 8 inches.

Westinghouse-American combined brakes on drivers, tender and for train.

Westinghouse 9½-inch L. H. air pump.

Three 2½-inch consolidated muffled safety valves.

One N. & Co. No. 9 triple sight-feed lubricator, 1899 type.

All springs by A. French Spring Company.

Franklin sectional asbestos boiler lagging.

Leach sand blast.

Gould couplers on front of engine and rear of tender.

National hollow brake beams on tender.

One U. S. Hdl'd. Co.'s 16-inch round case headlight.

One Utica steam gage.

Water scoop on tender.

Early Struggles of Senator Depew.

Senator Chauncey M. Depew has been interviewed by a reporter of the Chicago *Daily News*, and it appears that our great orator had as hard a struggle to secure a foothold on the ladder of fame as many others who were reared under more adverse conditions. Mr. Depew was the son of a well-to-do Dutch farmer, who was able to send his son to be educated at Yale. After that the father decided that Chauncey must make his own way and he kept to that sensible resolution. Concerning his early struggles Mr. Depew said:

"I had the usual troubles of a struggling young lawyer, and sometimes I thought I had greater than others. My tribulations were so acute at times that they caused my father to cry, but he would not help me. I thought that he acted harshly, and I am afraid that for the time I lost my affections, but I have since blessed him. I know that with my easy-going disposition I would never have amounted to much, yet I have not had the 'sand' to treat my own boy that way.

"While studying law in the village of Peekskill I made speeches all over the county at fairs, political meetings, Sunday school meetings, Bible societies, firemen's anniversary parades and target shoots, at which I bestowed the prizes as eloquently as I could. I belonged to the fire company in my village, and it was the custom in those days to have the tournaments with other companies along the Hudson. The company acting as the entertainer would give a dinner in the engine house, and I would deliver the oration.

"We were often beaten on the squirt, but always knocked off the rest in speechmaking.

"Well, so it came to pass that when I opened a law office at Peekskill I was very well known. A farmer came in, asked my advice and engaged me to draw up some papers. This bit of business took me most of the day, and I charged him $5. He said if my fees were exorbitant as that I would never succeed.

"The farmer gave me $1.75, and that was the first money I ever earned.

"Twenty years afterward some persons came into my office hastily and said they wanted advice on a matter of great financial magnitude, to be decided at a conference at the Windsor Hotel, New York. They wanted an immediate decision covering substantially the same question brought to me by the farmer who had paid me $1.75. I gave my decision at once, went to the hotel and there wrote an opinion which was subsequently approved by Charles O'Conor, then the great legal light of New York.

VALUE OF REPUTATION.

"My fee for that service was $2,500, which shows the value of reputation.

"In practising law at Peekskill I have driven ten miles over the mountains, tried before a justice of the peace a case which lasted from noon until 4 A. M., and then driven home. I have done that in all kinds of weather, and always was perfectly satisfied to receive $10 for that much work.

WORK HARD AND PLAY HARD.

"There are rare instances of men discovering a mine and otherwise making money by luck, but I never have placed any reliance on it. All my life I have worked from twelve to sixteen hours a day, and then I have taken vacations and played just as hard.

"I believe in vacations. After ten months in the case of brain workers the gray matter is wearied and has to be spurred until blood comes. This causes rheumatism and digestive troubles. After taking a vacation of four to eight weeks I can do satisfactorily in two hours what before, after three hours, I thought resulted in pretty poor stuff. Stick to your calling and stick to one place."

Head Dress of Early Trainmen.

Within the last six months the writer has been engaged looking up information concerning the genesis of our railroad system, and he has naturally examined a great many of the pioneer locomotives and cars. There is one thing connected with the pictures of early railroading, which is the persistent fondness of trainmen for plug hats. No matter under what circumstances they may be found at work, conductor, engineer, fireman and brakeman are all arrayed in long silk hats. There is no cab and very little shelter on the cars, but no matter, rain or shine, there stand forth all the trainmen, holding up their defiant hats to show how far the wearers stand above the discomforts of environments. But at that time the plug hat appeared to be in its zenith, and it would not seem fair to have covered the heads of the most conspicuous men in the country with anything less impressive.

This fashion of covering railway men with silk hats was not confined to America. In old prints of railway officials performing their responsible duties on European lines, we find them arrayed in the imposing plug hat, that mark of distinction being particularly conspicuous in the case of flag men, who are seen waving their signals with the towering hat always in evidence. Railway officials evidently wanted to have their trainmen display some distinguishing mark, but it took some time to find out that a head-dress which required constant attention to keep in position would not pass through the ordeal which leads to the survival of the fittest.

Multiple Sanders.

The latest improvements in sanders supply sand to two pairs of drivers going ahead and one pair backing up. In forward motion the leading and main pairs get the sand, in backing only the main pair.

This is particularly valuable on curves where the tread of all the wheels may not be in an effective position on the rail, and for heavy, powerful engines it lessens the shock on the main crank pin by dividing up the work more evenly. That is, if the engine is slipping, or would slip without sand, only the sanded wheels hold, and the pins of these wheels take the strain.

The cab valves are arranged, however, so that one or both pairs can be sanded at will, and the operation of these devices is said to be very satisfactory.

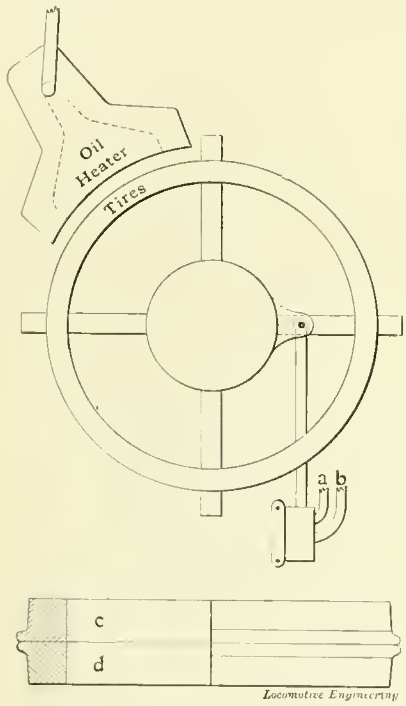
The following letter from Henry Guy Carleton, the playwright, to a maker of storage batteries is too good to keep. It might apply to some other commodities also: "I have the honor to report that the four-cell alleged storage battery vended by you to us is not worth a something which cannot be expressed in a dictated letter, because my secretary belongs to the church. In the first place, the dodgasted old thing leaks electricity at every pore, and sweats current faster than a dynamo can pump it in. I filled up the slam-banged thing day before yesterday for four hours, and with only ten minutes' work on my Ruhmkorff it has acquired a tired feeling, paralysis of the amperes and rheumatism in two of the volts. Really, the flabberjibbled whoof of a jabtit who put the thing together must have got some of the ends mixed up, or put in too little vinegar, or too much pepper, or not enough oil, and I would like to have your eagle eye look into it."

We do not know of any train mechanism that works every day in the year with less attention than that which operates the Pintsch system of car lighting. While traveling, on an average, 10,000 miles a year or more, we have never seen anything the matter with the Pintsch lights. The mechanism is said to cost less than $2 a year per car for maintenance.

At the Juniata Shops of the Pennsylvania Railroad.

The burning of the blacksmith shops at Juniata early in January was a big handicap in getting out much-needed engines, but it allows a remodeling of the shop which will be an improvement in many ways. All piping will be underground. The exhaust from the steam hammers go to a central exhaust pipe which is in a conduit down the center of the shop, the outlet being carried to the roof at one end.

They are also putting in the down-draft forges of the Buffalo Forge Company and running this outlet in the same conduit. This also holds the steam pipes, and a man-hole at each junction gives ready access to the valves controlling the hammers. When completed it will be a thoroughly modern shop.



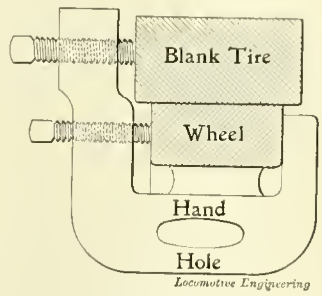
Tire heating device

FIG. 1.

In the wheel shop there are several interesting features, chief of which is the tire heater devised, we believe, by the master mechanic, Mr. Brown. The sketch gives a fair idea of this, but it should be seen to be appreciated. It consists of a central base supporting four arms which carry any sized tire used and an oil heater which can be swung into position for the different diameters. This heats the tire locally as shown, but as it is revolved slowly the heating is uniform and rapid despite the exposure to the air. The turning is accomplished by a ratchet operated by a little hydraulic motor, *a* and *b* being the inlet and discharge pipe from this. It is a step-by-step motion, but moves very evenly and without jar. In using this a pair of tires are placed on the arms, as shown by *c* and *d*, and both heated together. The axle, with wheel centers in place, is stood on end beside the heater, and when the tire is ready the top one is lifted off and dropped in place over the upper wheel center. Then the whole thing is lifted and the other wheel center dropped into the lower tire. As there is an offset in the tire, something like the retaining ring style, there is no difficulty in dropping them into their right place.

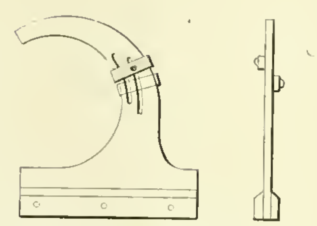
For blank or flangeless tires which have no such offset, they use a tire gage as shown. As will be seen, this is almost a regular machinist's C-clamp with an extra set-screw. Three or more of these clamped to the wheel center by the inner screw and the outer screw placed at the right place, make a simple and positive gage.

The Pennsylvania road have adopted—on their lines east of Pittsburgh, at least—the very sensible plan of cutting their eccentric key-ways in line with those for the wheel-fit. They use double eccentrics—that is, both cast together—and find that this saves both time and chance of error. Both key-ways are milled at one setting.



Tire Gauge

FIG. 2.



Fixture for laying out Key-ways

FIG. 3.

For engines with key-ways milled in the old way, Mr. Irvine, the foreman in the wheel shop, has devised the fixture shown. This consists of a sheet of steel, possibly 3-16 inch thick, with a base built up as shown. This has grooves which carry the pieces shown, these being the size of key used. There is one on each side, and by placing this over the axle, the base being on the bed of the milling machine, the center line of wheel-fit key-way is brought to the arrow-head at top, and then the key-way scribes from the blocks.

Mr. Irvine also has a scheme for locating the crank-pin with reference to key-way, that is simple and effective. The key-way is to be in direct line with the center of the axle and the crank-pin, so the template shown is used. This is also of sheet metal, with bosses or projections shown. The button-head *A* is pressed into the center of axle, while the pin *B*, which is flattened to the size of a standard key, is placed in key-way. Then all that remains to be done is to scribe the outlines of the crank-pin hole on the wheel center, and it is ready for the quartering machine, the workman setting it to the mark scribed.

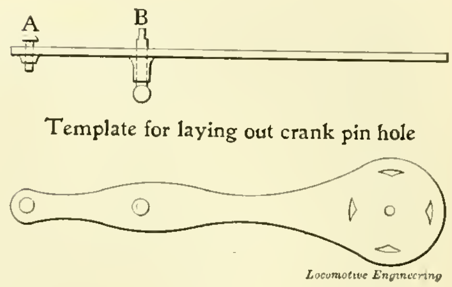


FIG. 4.

This brings us to the question of boring the crank-pin hole and the tools used. With cast-iron centers it is an old problem that has been solved, but with cast steel there is yet something to be said. The metal is so much harder than cast iron that tools do not last as long, and this operates against the use of reamers to finish holes of this kind, so as to obtain an interchangeable system of crank-pins.

The tool shown looks about like a double-ended lathe tool, and is probably as near like that as anything. It is about 1¼ inches wide by ½ inch thick, and held in the end of a boring bar as shown. This is said to last for finishing five or six holes without appreciable decrease in diameter, but pins are made for each hole, instead of being made up in lots.

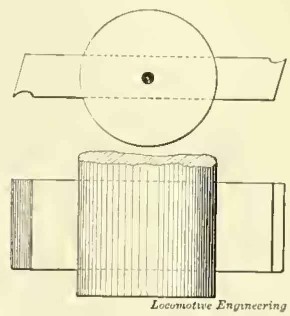
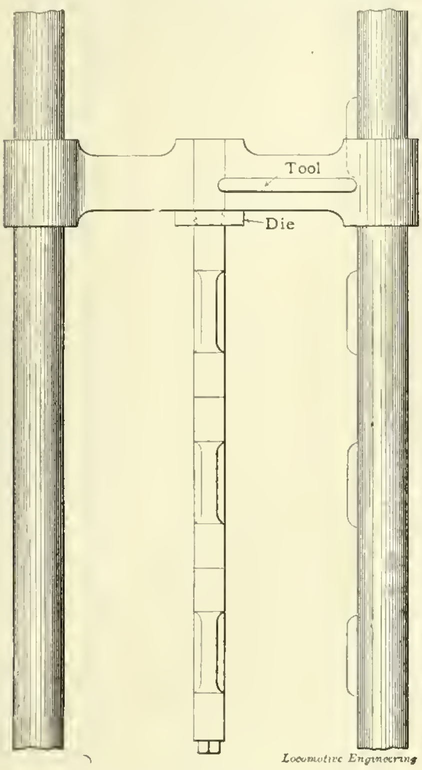


FIG. 5. CRANK PIN HOLE BORER.

This also brings up the question of the proper allowance for forcing fits with steel centers, and as usual there is a wide divergence in opinion regarding it. Some claim that one-third the allowance for cast iron is ample to give the same press fit; others say one-half is none too much.

Improvements are being made in the machine shop, also in the way of new tools, and some of these will make interesting reading later. Mr. Timm is a great advocate of the cold saw, and uses it to cut costs as well as metal in every case possible. In the staybolt department Mr. Epright's ingenuity is manifest, and one little attachment of his for reducing staybolts in the center is worth mentioning. It is simply an addition to the regular die head on the staybolt machines, which consists of two upright guides with the blank revolved between them. Down one of these he put in guide-blocks as shown,



Reducing Staybolts

FIG. 6.

and on the die head fitted a neat attachment carrying a turning tool. An idea of the action is given in the rough sketch, and it will be seen that the tool is simply forced into the work by the guide-blocks. The construction of the device, however, shows the work of a thorough mechanic, and it has been doing its work for a year or more. In the absence of blueprints it seemed best to give the idea as simply as possible, rather than to attempt an elaborate sketch. C.

Railways in Jamaica.

The principal mode of travel in the larger part of the island until the last few years was by carriage, there being a network of excellent roads. For some time there had been a steam railway, operated on the English plan, for a short distance from Kingston into the interior.

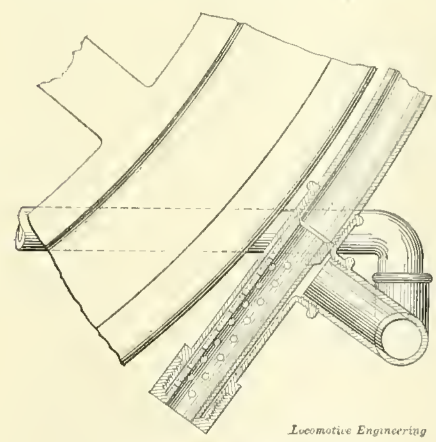
Some four years ago this road was extended 113 miles northwest to Montego Bay and 75 miles northeast to Port Antonio, thus connecting the three principal towns of the island. The road was built by an American company. The cars and locomotives are principally in the American style, except on the old portion of the line, where they still use English locomotives and compartment cars. Ordinary coaches for the masses are called third-class, and the rate of fare averages 2 cents a mile. These cars have compartments cut off for a small number of first-class passengers, who pay an average of 4 cents a mile. The time occupied in making the run to Port Antonio is about four hours, and to Montego Bay about six hours. There is quite a little climb over spurs of the mountains.

For some years there has been a horse railway in Kingston, but an electric road covering the lines of the old horse cars and other thoroughfares as well has just been completed. This new line has about 25 miles of track in and around Kingston, divided into three districts, viz., the lines north of the city, those east of the city, and those in the city. It is a private enterprise, started by Canadian capital, and is called the West India Electric Company. The government license is for a period of thirty years, renewable for further periods at the pleasure of the governor. The company pays 4 per cent. of its gross earnings to the government, and assumes the maintenance of the roads and streets occupied by it to the extent of 18 inches on each side of the tracks.—Consular Report.

Sand Pipe Cleaner.

The device shown is the invention of Mr. J. H. Hanlon, of Boston, Mass., and is for cleaning sand pipes that clog, or preventing it by occasional application.

As will be seen, there is an annular chamber outside the sand pipe through



HANLON'S SAND PIPE CLEANER.

which air is blown into the pipe, to clean it. This detaches the accumulated sand from the pipe and blows it out.

It has been used to some extent on the Fitchburg Railroad, and is reported to have given satisfaction. A device of this kind that will keep the pipe clean and do away with the necessity for working at the pipes every trip, or oftener, would seem to be a desirable invention.

Lubricating Valves in Compounds.

Master Mechanic Schaefer, of the Central New England Railroad, has improved the lubrication of the valves and cylinders on his compounds by a novel and ingenious method. It is rather a hilly road, there being an 11-mile drift, and the big cylinders try to draw in all the surrounding atmosphere, together with hot gases and cinders.

One of his engines had the air pump exhaust tapped in the exhaust cavity saddle on one side, and he noticed that the valves and cylinders on this side would be in good shape, while the other side would be dry and often cut. So he put all the pump exhaust into the saddles, but divided it with a "T," so it goes into each side of the saddle. A little hole—about 1-16 inch—in the bottom of "T" provides a drip and prevents freezing.

As the air pump is at work most of the time going down hill, the exhaust gives considerable steam and oil to be drawn into the cylinders, and it helps the lubrication to a marked degree.

He also introduces a little of Dixon's flake graphite into the relief valve about once a week, and seems to think it pays.

The Bard Adjustable Bushing.

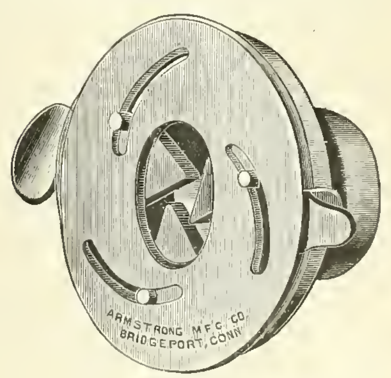
The accompanying illustration shows the Bard adjustable bushing, a new appliance for use with die-stock of all sizes.

The bushing is fitted with three hardened jaws, which are moved to and from the center by means of a cam plate, and by fastening the plate with the thumbscrew the jaws are firmly held in any desired position. The bushing is made to fit any die-stock in place of the common ring bushing and adjusts to any size pipe or bolts, and when once attached to the die-stock it may always remain there.

The adjustable jaws always make a perfect center for the pipe, and, fitting closely around the pipe, insure cutting a straight thread. This is a decided improvement over the old bushings.

In threading short nipples with this bushing, it is never necessary to file down the coupling of the nipple holder, as it is with the ordinary bushing. All this trouble and delay is overcome by the adjustable bushing, which is fitted to any size.

For old die-stocks where a leader screw or follower is necessary, No. 3 bushings are made (taking up to 2 inches), combined with a leading screw, all in one tool. This is an especially useful addition to an



ADJUSTABLE DIE STOCK BUSHING.

old-style 2-inch die-stock using solid dies. It is made by the Armstrong Manufacturing Company, Bridgeport, Conn.

Double Heading.

C. B. CONGER.

So the double-heading system has come up on your line? And you don't like it? Well, that is nothing new; neither the double-heading nor the dissatisfaction on account of the practice. Pulling heavy trains with two engines coupled together is becoming pretty general; it has some advantages and some disadvantages.

Nowadays money is made by hauling freight in larger carloads than formerly, so that there are a greater number of pounds in the car unit, and by having more of the cars in each train there are a greater number of cars in each train unit. Then, again, the less number of trains that there is on a line at one time, the less will be the delay; if the same number of cars can be moved in two large trains that formerly went in three small ones the possible delays of meeting and passing other trains will be reduced. It is, of course, granted that a small train can be handled some quicker than a heavy long one, but the fact still remains that the condition of profit or loss in the movement of a certain number of tons of freight is what governs all railroad operations in the long run; to these conditions we must accommodate ourselves.

Where railroad companies have a lot of moderately small engines in freight service, and they are not able to secure any larger ones, the average train haul in tons is raised to a profitable point by using two engines on a train instead of one, and this is something that will always be done. Our question now is: How can the disadvantages be most successfully met and helped out?

Among the disadvantages, especially on a dusty roadbed, is that the following engine is so covered with dust and sand that it usually runs hot, and certainly wears out faster; the men also tire out faster, both physically and mentally, from the confinement in the dust and cinders. This is the uncomfortable part of double-heading. Until the men get used to working in a double-header, the engines are not handled in unison to do the same work simultaneously, as a single engine will do it. This is found to be the case especially in starting the train. The practice usually is to have the head man take the slack out of the train as far as possible. If he is not able to start the train alone the second man then helps out. On one important railroad the reverse of this is the practice. A series of experiments showed that there was a less number of break-in-twos or damaged draw bars when the second engine worked steam first in starting the train, and the leading engine worked steam afterward. It is more a matter of care on the part of both men, than the particular engine, which starts the train, as either method can be successful.

There is some dispute as to whether the trainload for the two engines when coupled together should be as much as both of them would pull in two single trains, or whether it should be less. If the grade of the road has short sags and hogbacks in it that are liable to break the trains apart, it is wise to shorten the train; but on even track most of the double-headers take the same tonnage the two engines would pull separately. It is said that a helper engine can handle a larger train if pushing it around curves and crooked track, but we do not see how that is. Anyone who has tried to push a train around a Y, and then pulled the same train out of the curve will see the difference.

When we come to handle the air brake on a long train drawn by more than one engine, the difficulties increase. The temptation to use the air pumps and main reservoirs on both engines to charge up and maintain the air pressure in a long train with many leaks is so great that it is not unusual to find both engines cut in and feeding air into the train pipe at the same time. If a single large engine was drawing this same train one pump would have to hold the pressure up, and there is no reason why it should not be done with the train when drawn by two small engines.

On hilly roads and in mountain work but one brake valve should be cut in, as the risk of a runaway, in case the second brake valve is not cut out at the proper times, is very great. It only takes a few seconds for a train to get the start of the man doing the braking if anything interferes with his work.

The question of connecting the main reservoirs by a pipe and hose between the engines is coming up for consideration, and the success of this plan for handling the brake is assured. On one important line where heavy double-header trains are the rule, a separate line of pipe runs along the left side of the engine from the main reservoir, with air signal hose couplings for making the couplings between the engines. Air signal couplings are used so this main reservoir line cannot be coupled into the air brake line by mistake; check valves are in the couplings similar to the ones used years ago with the straight air brake, so that in the event of a break-in-two between the engines the check valves will seat and retain the main reservoir air. On another road the air signal line is used for this purpose. A by-pass is put in from the main reservoir to the air signal pipe, so the air can go direct without passing through the reducing valve. A cut-out cock is located in this by-pass pipe, which is open while double-heading and closed when the air signal is to be operated. If this by-pass pipe was located in the cab, connecting the main reservoir pipe near the brake valve to the air signal pipe, it would then be under control of the engineer in case of break-in-twos or a bursted hose.

Two engines on the head end of the train will weigh more than one engine having the same tractive force. This excess of weight is liable to break the train in two; it certainly is liable to strain the draft gear. The draft rigging has a certain limit of strength; when this limit is exceeded, as in the case of two heavy engines, the rigging will give way; which emphasizes the fact that such trains must be handled with great caution. This is the case at water plugs. It is better to cut off the engines from a freight train at such times than try to spot the train twice when taking water.

Double-heading is a delicate question to discuss here, there are so many sides to be considered, and the economy in handling trains—not the economy of engine repairs—will be the side that wins out. While it is uncomfortable to be second man on a double-header, it is no more uncomfortable than handling the same train with an engine as powerful as the two smaller ones. Extra large engines are no prizes if a man looks for an easy time on the road; besides each large engine puts the crew of a small one out of service, unless the business of the road increases as fast as the size of the engines.

Competition has cut the price to the shipper of hauling a ton of freight one mile down to a very low margin for the railroad. It is not likely that competition will ever stop, and the matter has more to do with increasing the average trainload than anything else.

"But you have not said anything about double-heading trains over the mountains," you say?

That is something that is so necessary that we need not discuss it. On some bad hills it takes three engines—two ahead and one pushing—to handle a full train for the valley road, and we cannot change that. It is the double-heading on the levels that is the tender subject to talk about. We meet it every day, and it will be with us more in the future than in the past.

The Pennsylvania Railroad have part of the well-known horse shoe curve in the Allegheny Mountains laid with rails that contain about 3 per cent. nickel. The nickel steel rails were made as an experiment, but they appear to present great durability in the hard service to which they are subjected. There was much difficulty experienced in rolling the rails, which are 100 pounds to the yard. If the experiment proves a success it is expected that methods for overcoming the difficulties of rolling will be devised.

The officials of the Vandalia line have taken a very sensible course in helping their firemen to do their work according to scientific methods. They have a school of instruction at Terre Haute, Ind., and lessons in firing are given in the furnace of a stationary engine.

General Correspondence.

All letters in this department must have name of author attached.

Taking in Engine With Broken Axle Without Disconnecting.

In last issue of LOCOMOTIVE ENGINEERING I noticed an article from Engineer V. C. Randolph relating to a consolidated engine, which he was running, breaking a main driving axle entirely off between hub and box. He states axle broke, without further damage, when he was 1½ miles from terminal, and that he brought engine in without disconnecting. As I was foreman in charge of repairing this engine, I wish to state, for the benefit of Mr. Randolph, that he was mistaken as to amount of repairs necessary to place this engine in service. On examining this engine after arrival at shops, I found side rod on both sides quite badly bent, bottom leg of side-rod strap at this connection broken off, all four eccentric blades bent the same way, probably caused by wheel working out, as tire had no flange; also top rail of main frame broken about 15 inches in front of this axle center. Although this might not have been done by taking engine back to shop without disconnecting, I think it was a very risky thing to do. He should have disconnected this engine, letting the wheel broken off fall clear of the track, as it was on'y held up by side rods; blocked opposite wheel to clear rail and be towed in. I certainly think he was very fortunate in getting an engine to shops in this condition without the aid of wrecking train. Am I not right? J. J. DEWEY.

Hornellsville, N. Y.

A correspondent in the March issue asks: "If a consolidation locomotive should break the main driving axle on one side, would it be necessary to take off the side rods on the opposite side to run the engine home under steam?"

We understand that this means the light engine without any train. At the risk of drawing the criticism of others, I will answer: Leave all the rods up on the side you are working steam, if all the rods are taken down on the disabled side.

We will take the case of a main axle that is broken off close to the wheel, leaving the journal in the box, so the end of the axle is held steady and cannot work around. Of course, with the main wheel gone, all the rods on that side must come down. Some engines have all sections of the side rod connected with knuckle joints in the rod; others have a separate bearing on the crank pin of the third pair of wheels for the back section, in which case there is no reason for taking this section down on either side.

It is an old rule among engineers, to take down the side rods on both sides in case they are taken off on one side. This is to prevent damage to the side rods and crank pins if one side only is in service when *both* cylinders are working steam; for when the engine on the side that has no side rods working gets up toward the quarter, the forward wheels are liable to slip; the side rod still up on the other side being on the center cannot slip the back wheels at the same time the main wheels slip, and the rods or pins may be strained or broken.

Now, if you are working steam on one side only, as is surely the case with a main driver gone, when the main rod is up toward the quarter where it has power to slip the main wheel, the side rod will be coming up toward the quarter also, and cannot be strained any more than if the side rods on the other side were still working. The main wheel does not slip when its pin is on the center for the one cylinder working steam; when it gets up where it can be slipped by the steam, the other wheels have their crank pins in the same position. It is not the power of the piston on the side that has the side rods in service that does the damage; it is the one on the other side of the machine. If this one is disconnected, it cannot hurt the side rods any to be left in service.

Suppose we take all side rods off in the case of this locomotive with one main driver broken off. You will then have the adhesive force of only one driving wheel of the eight to start the locomotive. She will be very apt to slip and catch on the center, and you will have to pinch her off every time—not a very easy process with an engine of this class. With all wheels coupled on that side, she will not be so apt to slip and catch on the center.

Speaking of losing the use of side rods brings to mind a case of serious delay from this cause. An eight-wheel standard freight engine broke a crosshead at a station. The engineer disconnected that side of the engine properly, as far as the main rod and valve rod were concerned, but also took off both side rods, because he supposed it to be the proper method. He then tried to set his train into the siding, a few cars at a time, but soon found out that when the engine got up close to the quarter, the single pair of wheels would slip over on the center and stop there without moving the cars, which delayed clearing the main line till the Limited came along. The side rods were put on after the other engineer had inspected the disabled engine, and the cars were soon in the siding and main track clear.

General rules for handling disabled engines are all right, but there are so many special exceptions that it pays to know and understand the why and wherefore of the exceptions. The general rule in regard to taking off side rods is one of them. Then there is the rule about disconnecting an engine when she is to be towed in on account of a disconnected throttle valve. It is rarely necessary to disconnect, but some master mechanics insist on it, whether in warm weather or cold. Towing an engine with her throttle closed is just the same as when she drifts down a long hill.

Then there is a general rule about disconnecting an engine for a broken back-up eccentric strap or cam, that has a number of exceptions which provide for taking off the broken parts fastening the loose end of the link and proceeding.

What we must have nowadays is the main line cleared of disabled engines or cars as soon as possible, and let trains move along on time.

Suppose the main axle was to break inside the box next the eccentric cam, how would you fix this engine up to come in with her own steam? How would you fix her to be towed in?

JOHN W. TROY.

Indianapolis, Ind.

In regard to Mr. V. C. Randolph's inquiry as to broken main driving axle: I was running a consolidated engine here several years ago, and had thirty loads coal 48 miles out from terminal, and just had turned top of hill when main driving axle broke about half-way of driving box (right side). I discovered it at once, stopped train, looked engine over. I took train to siding, heading in, it being down grade slightly to siding. After I got on siding it lacked one car of clearing siding, which car being billed in direction I had to go to get back to shop, I took car to station where it was billed and set it out, and then proceeded to shop, some 48 miles in all. This was done without doing any disconnecting whatever or blocking. I ran very slow. Backing up consumed 8 hours 45 minutes, and was moving all the time. There was no damage to rods or pins and very little to driving box.

MICHAEL O'CONNOR.

Knoxville, Tenn.

Setting Up Wedges.

Here is a good way to "set up" wedges, that I have never seen published in your journal: Set tank brake as a precaution: place crank pins of the side you wish to adjust on the back center; put reverse lever in or near center notch. You will then have a lead opening of about ⅜ inch in the back steam port of the side you are working on, while on the opposite side the ports will be covered. Open throttle and the driving boxes will be drawn against the dead wedges. Loosen set-screws in side of jaws and nuts under binder brace, and wedges may be easily pried up with a short steel bar. Run the nuts on top of binders down with the fingers, then tighten the nuts under binder and the side set-screws with a solid wrench and one side is finished. Place the crank pins of opposite side on back center and proceed in the same way.

I like this position better than any other for setting up wedges, because the side rods, having been put up on the center, are perfectly loose, and while the driving boxes are drawn up snugly against the dead wedges, they are not tipped in the jaws by the side rods drawing them, as is often the case when engine stands in any other position. CHARLES S. RINGER.

Buffalo, N. Y.

Diversity of Sizes of Pipe Unions.

I have wondered why someone doesn't send in a great big kick against the non-uniformity of pipe unions. If there was a standard to order from, it would save expense in reducing demand, save time in fitting and expedite completion of work.

I was looking at a pile of pipe scrap the other day, and I couldn't help congratulating myself that I wasn't a stockholder of the road and had to pay for those abandoned pipe fittings. We have a good system of operating our scrap yard. Everything of value that can be saved is saved and put to use; but to save those separate pieces of unions and disconnect them from their fastenings, would cost more than they are worth, for they don't know each other; so when we want a union we don't recognize those orphans from the scrap, but draw new ones.

When I am president of the road, the first thing that I intend to do is to set my force to work in figuring out how much money was paid out for gas-pipe unions during the past year, and I shall just save the figures for reference. Then I shall instruct my purchasing agent to contract for further supply according to the specifications following.

Threading and dimensions of pipe unions shall be of the size of the thread and dimension of gas pipe twice the size. For instance, the union nut of a ⅜-inch union must turn on to a ¾-inch pipe nipple, etc.

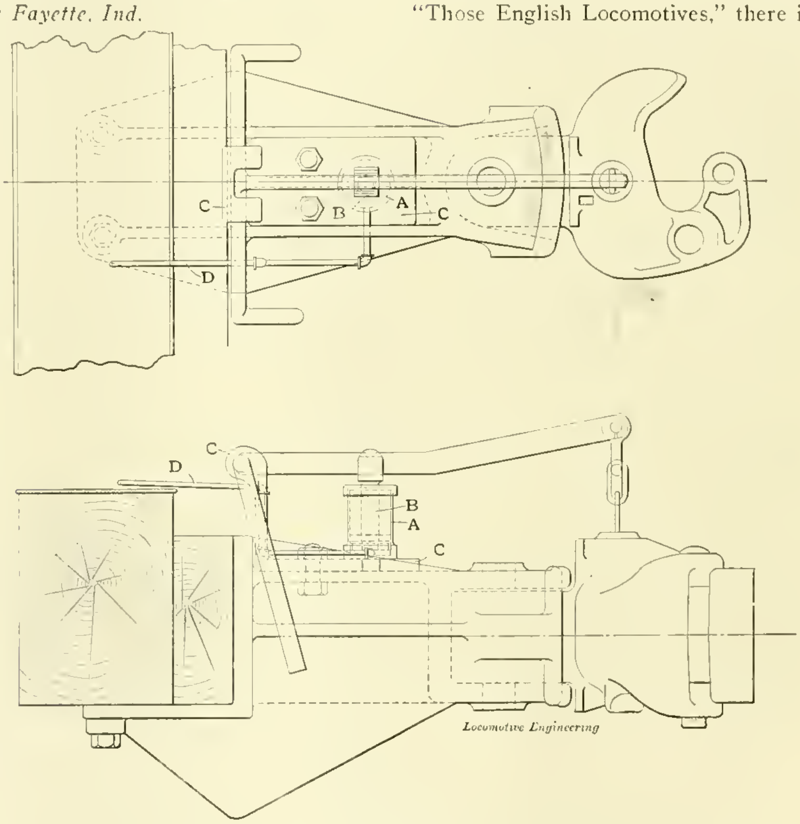
The advantages are understood by workmen. If the threads are battered, standard taps or dies will renew them. Connection can be made direct, when necessary, between a pipe and another of twice, or half, the size, by the standard union.

They must have hexagonal circumference, the size of which may also be made standard, so that regular sizes of solid wrenches will fit; or the monkey-wrench can be used. When a common union is drawn close on to the taper screw of a pipe, about one out of six of the common unions of commerce splits; the ruined part is scrapped, and its mate becomes another orphan of the scrap yard.

In making unions large enough to take a square wrench, the reinforcement of metal extends the life of the fitting, and shortens the labor of the fitter.

W. W. WOOD.

La Fayette, Ind.



HONE COUPLER.

Hone Coupling.

Enclosed find blueprint illustrating an appliance to be known as the "Hone coupling and uncoupling device," for engines and cars. Its object is to curtail the danger to switchmen, brakemen and other trainmen in the matter of coupling and uncoupling cars, besides which it will be found a quicker and more efficient instrument than the hand power.

It consists of a cylinder *A*, piston *B*, lever stand *C* and air pipe *D*. The cylinder device in its present shape consists of a tube placed under the uncoupling lever, so that the piston lifts the lever, drawing the pin and opening the knuckle. The piston operates by means of air or steam carried through a small pipe attached to bottom of cylinder, and operated by engineer from cab; or it can be operated by the brakeman as well. The cylinder rests upon lever stand, being connected thereto by a stud.

This device has recently been put in practice by Mr. A. C. Hone, superintendent of motive power and rolling stock of the Evansville & Terre Haute Railroad Company, being placed in service on one of the engines belonging to that company, and found to work with great success.

It is serviceable with any make of coupler, and is intended to cover, as well as engines, freight and passenger cars of any description.

ELMER MCCUTCHAN,
Chief Clerk, S. M. P. & R. S.

Evansville, Ind.

Long and Short Valve Travel.

In your February issue, under the title "Those English Locomotives," there is an article in which the author, Mr. Frank Gleason, asks for opinions as to whether short valve travel is conducive to economy. Our experience of many years has convinced me that short valve travel is economical. Our service is on heavy grades and at slow speed. J. G. BEAUMONT,
Supt. M. P. and Mach., Member Amer. Ry. M. M. Asso.

Arequipa, Peru.

The Atchison, Topeka & Santa Fé Railway Company are building, at their Topeka shops, ten all-steel 40-foot ballast cars of 80,000 pounds capacity. The building of steel cars by a railway company is something of a novelty. However, immediately on the completion of this lot, it is contemplated to build a steel box car of 80,000 pounds capacity for trial.

Steam Used for Injectors.

I have noticed all discussions in your valuable journal relative to the injector being worked by using much or little steam. It has always been my practice to use just enough steam to take up all water at overflow—then if more steam be used, what do we accomplish? In the question lies the answer—we use more steam than necessary. W. B. Van Horn.

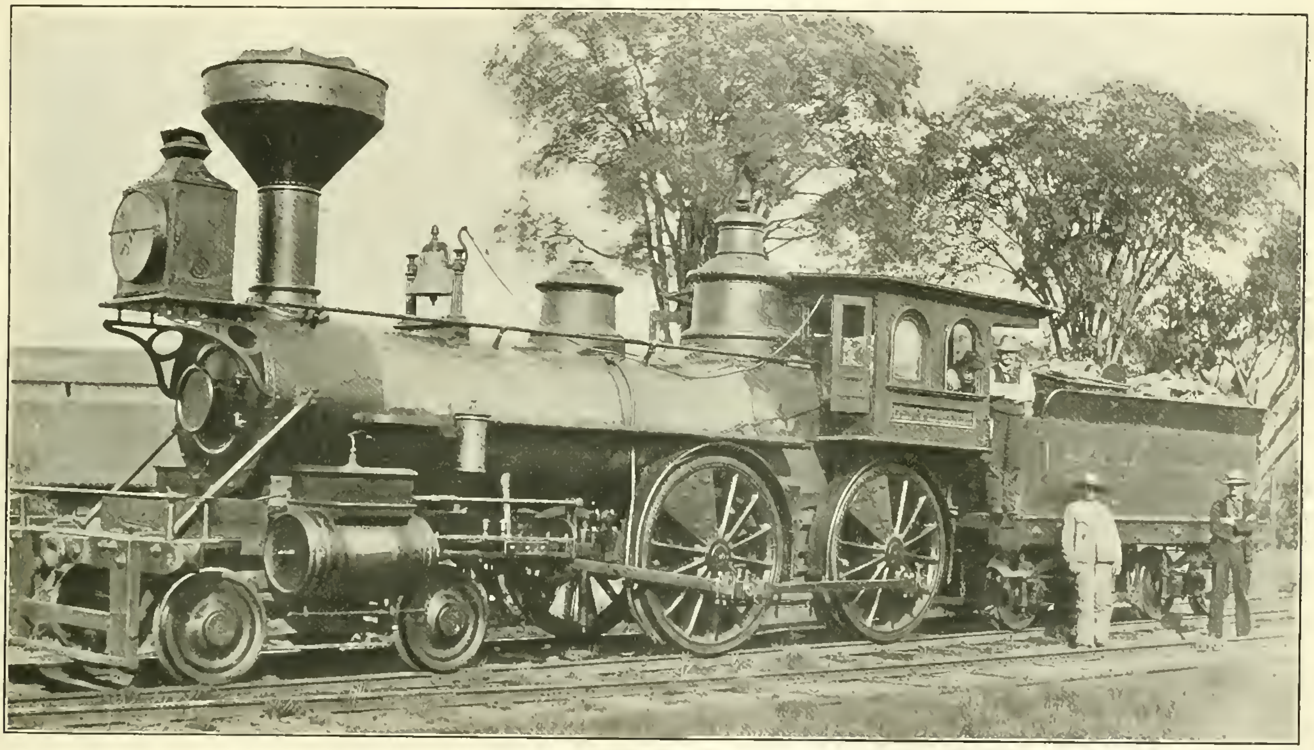
Wadsworth, Neb.

Old Concord Engine.

One of our Somerville friends, Mr. Frank G. Yeaton, sends us a photograph of the old "General Peaslee," which is shown herewith. This was No. 26, and was built in 1865, in the railroad shops at Concord, N. H.

As will be seen, it was an eight-wheel wood-burner, and was considered to be the largest locomotive in New England at that time. It made its first run in March, 1865, and for the next seventeen years it ran the Central Vermont Mail between Concord and Nashua, 35 miles. Up to about 1886 it had a red stack and red wheels, which were considered marks of distinguishing beauty at that time.

When the Concord road and the Boston, Concord & Montreal consolidated, in 1891, the "General Peaslee" was degraded to shifting service, where it remained until August, 1895, when it was retired. This photograph was taken the day before it was finally put out of service.



ONCE THE LARGEST LOCOMOTIVE IN NEW ENGLAND.

Burning Lignite.

On the line of the Houston & Texas Central Railroad there are mines of lignite, a variety of coal of low heating power which gives trouble on account of the sparks setting fires along the right of way. In this respect it is as bad as wood, and cannot be used with the ordinary extension front end and straight stack. Superintendent of Motive Power Tuggle altered a number of their engines having extended front ends and straight stacks, so they use this lignite with very good results.

The extension was left the usual length, the netting taken out of it, the straight stack taken off and a diamond stack having 3½ mesh netting put on. The apron or diaphragm plate used with the straight stack was left in. It comes between the flues and steam pipes and extends about halfway down the flues towards the bottom of the arch. The exhaust tip was a low one, about 14 inches high. A petticoat pipe was used, so that with the exception of the netting in the smoke arch, the engines had the draft arrangements for both the straight and diamond stacks.

These changes were made some four years ago, and the lignite has been used ever since. The engines steam freely and throw very little fire. The lignite is mixed about half and half with bituminous coal when put on the tender. Two tons of this lignite are about equal to one ton of good coal, but having the mine on the line of the road makes a difference in its economical use. It is not unusual to burn lignite in short fronts and diamond stacks, but long front ends are not common for this fuel.

Through Siberian Railroad Shops—Notes on Practice and Machinery.

BY L. LODIAN, PARIS, FRANCE.

The chief shops on the great trans-Siberian railroad are at—as you travel overland from the Pacific to the Urals—the squalid village of Nikolski, 100 verstas north of Bladiboctok; then Kabapofck, on the Amur; next at Chita, between the Iablori and Altai ranges (the construction of the Stretenck shops on the headwaters of the Amur, having been abandoned—due to the change of route across Manchuria) and next at Ipkytck, the biggest of the dirty big villages of Siberia. Ipkytck is right in the heart of Siberia, about 60 verstas from the inland ocean-like lake known as the Baikal—the largest of the lakes of Asia, and probably the most beautiful of the great lakes of the world. Henceforth, traveling west, the line is known as the central and western Siberian sections, with chief shops at Kpacnoiapck, Omck and Chelabinck—the latter the last repair works in Siberia the traveler sees before crossing the Ural range to Europe; but the very last station in Siberia is called Cipoctan, and near here is the historic Asia-Europa dividing-line obelisk.

Between this point, however, and the Pacific Ocean there are scores of small shops for sundry repairs of a minor nature; but all big work has to go, maybe, hundreds of miles for attention. It is with these big works that the present article deals.

Taking them in the order inspected—

that is, traveling west from the Sea of Nipon overland to Europe:

The Nikolski shops are the best in that part of the globe. They are modeled after the newest American and Canadian works, and were entirely completed at the time of the writer's visit. The repair shops near Buffalo (Depew) I have always regarded as a model in railroad works construction, and it is a very near imitation of the buildings—on a small scale—which has prevailed at Nikolski, in Eastern Siberia. The little parties of Russian engineers sent out—mostly in twos—by the Russian railroad authorities to study American methods, certainly made good copyists, although they created nothing original.

The Nikolski works are of red brick, with ample windows, which are mostly built in double to—as was hoped—circumvent frost deposits on the glass, but all the same the Siberian winter deposits its thick coat of congealed condensation thereon. While the locomotives used on this Ycypi section are from America, I do not remember seeing any American riveting, drilling, shaving or turning machinery in the shops, nor were the tools American. They were mostly from German and Russian firms, but it did not take me long to see that a good deal of this plant was, after all, but a copy of United States articles. Thus, the compressed-air borers and hydraulic riveters were decidedly American inventions.

I noticed that throughout the Siberian shops the same jealous care was exercised over the tool room as everywhere else in the railroad shops of the globe I have visited—and my knowledge thereof extends from Argentina to Australia, Mexico to India, Europe to Japan, America to Polynesia, and Siberia to Iberia. The tools are rigorously checked as given out and taken in, and the tool room is, of course, always under lock and key ("keep out—this means *you!*"), with pass-hole in door. Force of habit more than importance has —I have often thought—much to do with this seeming extra carefulness, just as (to give a homely but outside parallel) your grocer hand-sweeps particles of tea—and dust—from his counter into the tea bin as carefully as if it were gold parings.

Although with the ample Belleville type boilers used in the Siberian shops there is always steam enough and to spare for efficient steam heating and electric lighting, the old brick stove (iron-cased) is depended on for warmth, and I never saw a single dynamo in the shops between the Pacific and Pocia. Kerosene lamps and candles furnish the illumination.

The workmen in the shops do not wear overalls while at work, as with us; but labor in the same clothes—mostly without even an apron—in which they go about the town or village. The result is, most of those you meet outside the works are conspicuous by a profusion of shiny, greasy patches on their clothing.

In his attire the Russian railroader mostly has a negligé appearance; but on that score the present writer—always preferring comfort to looks—does not claim any distinctive superiority. The Russ shop mechanic wears high military boots, or napoleons; so do locomotive engineers and firemen; drink milkless tea in fair quantities—four or five glasses—about four times a day, but never in "buckets," as described in an ignorant English book replete with garbage, entitled "Called Back."

It is not true that the Russian railroad hands are addicted to drunkenness any more than the same class of workmen in Britain or America. But, when drunk, the Russian has decidedly the best behavior. He never, for instance, uses the eloquence of the poker and tongs on his wife, à la Anglo-American. He is always in a good humor, docile, easily managed, and does the proper thing—sleeps it off. During two years in Siberia and Russia I never saw a single "half-tracks-over" Russ in a bad temper.

Lokbincki, Photo. Omck.

NEW CATHEDRAL AT OMCK, WESTERN SIBERIA.

RUSSIAN RAILROAD SHOPS BATH HOUSES.

One laudable institution—for I have always held that cleanliness is more important than godliness—about Russian railroad shops is the bath house. It is always a house in itself, with a regular salaried man, called the banchik, who gives the place his whole attention. There the shop hands take in common, free of charge, a regular Russian vapor bath. And a splendid disintegrant of grease and dirt it is! Scores of times have I taken the hot vapor bath in the same room with them, and have much to feel thankful for on that score. I have known a single bath to dissipate acute inflammation in the eye, premonitory tonsilitis, and the incipient stages of pneumonia (pricking sensation in the lungs on respiring).

As an instance of the social purity among the Russian peasantry I may state that in some of the isolated villages the young men and women take their hot baths in the same bath room in common.

Even the poorest Russian railroad employé—the lonely section hand who has his own little bydka (cottage)—will have his hot vapor bath. He builds it himself —preferably in the side of a ridge of ground or hill; but if on the steppe (prairie), he will dig into the ground a few feet, run in a lot of old sleepers as sustaining walls, and bank up firmly on the outside the excavated earth. The object strived at is to insulate the bath house as much as possible from the wintry blasts.

I have known the hardy Siberians to rush out from the sweltering bath house stark naked, descend the immediate slope to the river, draw a bucket of water through a hole in the ice, and rush back into the hot vapor of the bath. Others will dart out, vigorously roll over on the snow, and skip into the piping-hot bath house again. The practice is regarded as beneficial for rheumatism.

But to return to the shops. At Kabapofck the shops were not finished at the time of the correspondent's call. Dermidontof is, or was, the chief there. He entertained the Pangborn junketing party—so he did the writer. I learned the Pangborn party were seriously stranded for funds in the middle of Siberia—which the writer never was.

STRANDED LOCOMOTIVES AMID SIBERIAN WILDS.

Coursing the river Amyp, after a couple of thousand miles' inland journey, I saw a couple of Belgian skeleton locomotives stranded on barges in the river. There they were, rusting away, in the solitude of and among the wildest river scenery of Asia. They had been sent along quite a while before, making the long journey round Europe, through Suez, past Singapor to Japan and the Cagalin convict-island, thence to northern Nikolaefck at the mouth of the Amyp; now south to Kabapofck, and so on to Blagoveschenck, with destination to Stretenck, for the trans-Baikal lines. But the Amyp ran almost dry in parts—that stranded them; then news arrived the railroad would not reach Stretenck for many years to come, owing to the trans-Manchurian route being utilized. So the engines may be stranded there yet, or they may have been got off, and returned east for the Kabapofck-Bladiboctok section.

Here and there along the river, glimpses were obtained of the finished grading—much of it already covered with rank vegetation. A vast amount of this work was subsequently washed away by heavy floods; and the abandonment of the Amur route in favor of the new trans-Chinese road—which means the speedy disintegration of the work already done along the Amur—represents a loss to the Russian Government (that is to say, the people) of over 10,000,000 rubls, or $5,000,000—money sheer thrown away.

From the head-waters of the Amur (Stretenck, so considered) over the Iabloni range to Chita, is a beautiful journey along the great highway which reaches from the Amur to the Neva and Vistula, being over 4,000 miles in length—the longest made highway under the same administration on the globe. It is not at all, however, a first-class-built road.

At Chita, C. Iakybofcki, a Polak, is in charge of the shops, then being constructed. The Governor of Chita suggested I follow the building railroad from Chita to Bepcni-ydinck, but a hint from Iakybofcki of the marshes to be crossed, caused me to option for the plain country road. And probably I have no reason to regret. One previous Siberian experience of a marshy country was enough—six days negotiating a corner of the flooded Amur country, with water to the waist, on and off, every day; millions of small-size-spider mosquitoes around; the distressing ball-fields (tundra) to cross. It was a week of horror.

At Ipkytck, the site of the shops had been chosen, but not a building was up at the time of passing through.

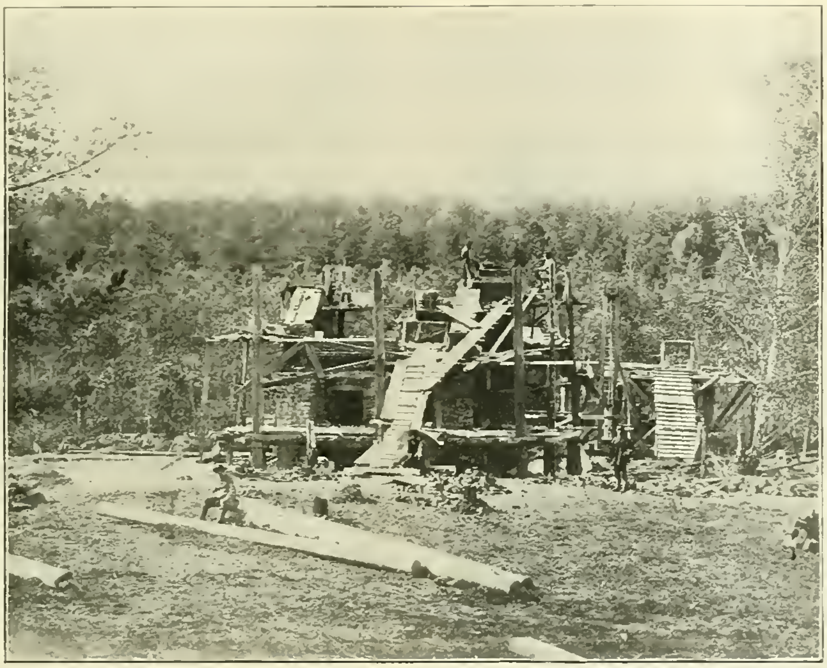
It is not till you reach Kpacnoiapck, 650 miles distant, that you meet with more shops of importance. They were nearly finished on my arrival.

AMERICAN TOOLS IN RUSSIAN RAILROAD SHOPS.

At Omck, you see the finest and biggest shops in western Siberia, covering several acres, with ample warmed buildings for car-painting in winter. The machinery is all Russian. Many of the tools are American—a proof that the traveler is getting nearer home. The Russians have a good opinion of American tools, if on account of their hardness alone. And well they might have! My own practical acquaintance with Russian-made "steel" (?) tools is that they are the worst yet made. Why, even those sold in the bazars of Sikim, and Nepal, and Butan, and other north Himalayan villages are better, made by squatting Himalayans and Tibetans with the crudest of materials, and finished off (for selling purposes) with their hands, using their feet and toes as a vise What do you think, for instance, of an ordinary Russian chisel, the fine edge of which, on attempting to split leather therewith, will "turn round the corner"?

SMITHS' SHOPS IN SIBERIAN RAILROAD WORKS.

But the smitheries at Omck were poorly lighted, without heating arrangements and choked with smoke. Just because smiths burn fires, it is assumed that their shops need no heating. This is one of those notions of theorists which is best corrected by asking the smith's opinion. I have known Siberian smiths' shops to be almost choking with smoke, every forge going, yet so cold as to freeze the cooling-water tank only a few feet from the fire. So the poor smiths work in their big, greasy sheep-skin overcoats, shut the ventilators, and dodge about in the smoke. They have to handle the tools wearing big skin gloves, or the frozen metal would pain them as much as if piping-hot. Where small work would make the gloves feel in the way, they have to warm the tools before handling.



Cbift, Photo., Cipoctan.

A STATION IN THE FORESTS, CENTRAL SIBERIA.

A LONE BRITISH LOCOMOTIVE ENGINEER IN SIBERIA.

It was in this part of western Siberia that I met—or tried to meet—the only English locomotive engineer in all Siberia. His name is Garly. I would like to have questioned him on his experiences, and made an appointment by card, but the party entrusted with the missive put it in his pocket, carried it around several days, forgot all about it—and thus I missed seeing Billy Garly.

But a great surprise was to run across, at Omck, near the railroad shops, an old American musician who has isolated himself for thirty years in Siberia and Russia. His name is Groves, and he hails from Boston. No previous traveler across Siberia has ever unearthed him.

Then, at Cipoctan, the last station in Asia going west, or the first going east, the station-chief is an Anglo-Russian—Jemmie Swift (spelt in Russian, Cfift). He is the only British-speaking chef-de-gare on Russian territory. At Ekatepinbypr there is an Anglo-Russian telegrapher named Penn, descended from a branch of our own immortal William Penn family. Queer—a Siberian branch of the Penns! I have already written their history—how they transpired in Siberia—in a special paper. At Ipkytck there are a couple of Anglo-Russian telegraphers—Sasha Grant and Niki Grant, of Scots proclivities in the two "w's," but unfortunately with no Scotch economy. One of them came on me for a loan. I paid it. Anticipating more loans, I diplomatically represented myself as needing all I had—"and those drafts, you see, it will take a few weeks to collect." To keep up the illusion, I made a show of desiring the loan repaid—a sure way of steering off a borrower; but, well knowing I should never get it, philosophically took it out in part-payment by imbibing scores of glasses of Sasha's fair wife's good Russian tea. Had it ever been suspected that the bulging in the belt under my vest was caused by the pockets of the belt being stuffed with rubls, the puffed-out state thereof would certainly have decreased. In Siberia—in fact, anywhere in the world—it is highly indiscreet to have it even *suspected* you are the bearer of ready-money worth "trying" after.

Finally, at Alekcandrofna, on the Polska-Pocia frontier, I met another English engineer driving on the line from the frontier to Warszawa. His name is Lip.

The foregoing half-dozen individuals were the only English-speaking ones connected with or along the line of the railroad I met in the course of two years' travel (12,000 verstas) over Siberian and Russian territory. And I had no desire to meet more; because the Englishman abroad is a queer animal—goes about in a dingy tweed suit ("because it doesn't show the dust"), wears a double-peaked cap, with nickers and socks, and shoes designed to "ship" a liberal quota of street and road dust. He likes to carry a squeaky concertina—the limit of his "musical" accomplishments. He usually carries a "dress-suit" in his valise, made *a la* Oscar Wilde. And the Yank abroad is not much better—apes the British monkey-dress; is (behind his back) ridiculed for his deplorable snout-accent, and "in America"-ises to such an extent in his comparisons that the innocent foreigner begins to think or suspect America must either be a paradise or a pandemonium.

It is the experience of every old traveler that the least desirable society abroad is that of his own country people.

But to wind up with the Siberian railroad shops: The last shops of note are at Chalabinck, the last big station in Siberia (if you are traveling towards the west). They employ about 250 men, who work—as elsewhere in Siberia—twelve hours per diem, making the usual poor wages, from 30 to 50 rubls per month ($15 to $25), with living expenses double what they are in America—so the poor devils only just live from month to month. Piece work is not common in the shops, but is being gradually introduced. As the men have no organizations, its general introduction will improve their lot only a trifle—if that.

SECTION ENGINEERS' "PAY" IN SIBERIA.

Apropos of the poor wages prevailing in Russia, I may state that many section engineers with regular well-executed parchment diplomas (worth about one-eighth of a cent apiece) receive only 120 rubls per month, with house and firing. Think of it—$60 per month for a section engineer! So they try to make ends meet by—in common with other Russian officials—stealing all they honestly can. It is an unwritten understanding in Russia that an ill-paid person has a right to steal—and the official classes fully live up to it!

The rocydap (Niki) draws an annual salary of 50,000,000 rubls ($25,000,000) for doing worse than nothing.

What strikes one on visiting Russian railroad works is the quantity of old metal rubbish knocking about everywhere. Every shop in American possesses its scrap-heap; but—bless you!—many Russian shops seem to half-consist of scrap-heaps.

In reply to inquiries, my route across Russian territory was along the 55th parallel, ranging from the 43d in extreme eastern Siberia to the 60th parallel in Northern Europe.

Some other day I may note on shops in central Russia, with items on visits to the government arsenals and foundries, also on the big locomotive works at Comofo (Hijni-Hofropod), which have already been detailedly covered in private reports.

Kruchkol, Photo., Tomck, Siberia.

WATER TOWER IN COURSE OF CONSTRUCTION, CENTRAL SIBERIAN RAILROAD.

Plain Talks to the Boys.

C. B. CONGER.

DEALING WITH BREAK-DOWNS.

The work of getting out the broken parts, blocking up and bringing in an engine having a broken driving axle, tire or wheel center, seems to be a matter of interest just now, so we will take it up today.

An axle usually breaks off between the hub and the box, probably because there is the most strain at that point. The main axle has the hardest service, for it carries the same or more weight of the engine than the other axles, gets the full force of the steam pressure against the piston, as well as the pounding from lost motion and wear of bearings. As more of the main axles break than of the other ones, we will take up the case of a main axle on a consolidation or mogul first.

If the wheel breaks off and gets away from the engine when going at a high speed, it may make a bad mess of that side of the engine. Sometimes it makes a clean sweep of rods and pins, together with damaging the crosshead and guides. If the steam is not shut off before the main rod gets loose, look out for cylinder heads also.

It is not unusual for an axle to break when moving at a slow speed and leave the wheel on the rail with all the rods in good order, so the engine can be moved to a siding and clear the main line. If she is to be moved with her own steam, blocking up is usually the first move. Do not try to load the broken wheel and rods that are pulled off. It will take too much time. If some train comes along, have them push the disabled engine into a side track and clear the main line.

If you have jacks that will lift the engine, raise her up and block the springs, equalizers and boxes over the good axles, so she will ride level again. To allow for settling on the blocks, it is best to block the disabled side a little higher than the good side of engine. If the springs are above the frame, this is not a difficult job, as the blocking will come above the frame. If the springs are underhung, it is more work. The pedestal binder under the broken axle will have to take the strain, as the block will come between the journal and the pedestal brace. If this brace is a thimble between the lower ends of driving box jaws with a large bolt through the thimble and jaws, it will hold most any strain on top of the brace. But if the brace is a wrought-iron strap reaching from one jaw over the other, held up by bolts going into the lower end of jaws or through the lower rail of the frame, the strain may bend this brace down or break the bolts. To avoid this difficulty, it will be well to block the ends of equalizers, just the same as if the spring was broken. Raise the box with the broken end of the axle up pretty high and block between the pedestal and cellar to hold it. With a broken wheel center or tire take out the cellar, so the axle will not get cut. If the axle is broken, never mind, as it won't spoil it any. If all the rods on the other side are in good order, you may leave them up. If the main rod on the disabled side is taken down, they will take no harm, as there will be no strain on the side rods when passing the centers.

If the jacks will not raise the engine—very few large engines can be handled with the screw jacks ordinarily furnished—you must run her up on wedges. Block on top of the rear driving box on that side and run the rear wheel up on a wedge. That will take the strain off the springs and equalizers, so you can pry up the box at the broken journal and block under it. Then put a block over one of the other good boxes, and run that wheel up on a wedge, letting the back wheel off. This will relieve the rear box, which should then be blocked up solid under frame to hold that side of the engine up a little higher than usual, so she will tend to hug the other rail. Blocks will also be needed over the other boxes on the good journals, to divide the strain, so journals will run cool. Remember that the eccentrics next the good wheel will hold that wheel from working out away from the box. See that the set-screws are set up solid.

If the main axle breaks inside between the box and the eccentric cams, get the wheel and piece of the axle out of the box, take off both eccentric straps, slip the cams over against the other ones, take down the pedestal binder, drop out the box, put up the binder again and slip in four pieces of plank about 30 inches long, as wide and thick as can be used. These planks will make a square box inside the jaws and extending along outside the axle, which will hold it in place, so the other wheel will run squarely on the rail, just the same as if the axle was broken off next the hub. You may be able to then move the engine with her own steam.

If the engine cannot handle herself with her own steam, get towed in. You will have the same work to do getting ready to move either way.

If a forward driving wheel on a consolidation or mogul is broken off, gets off the track and stays in behind the guides, it is a job for the wrecking car sometimes. If you can't get it out, the disabled wheel must be swung up to clear the rail, the side rods must come off this pair of wheels sure. Slinging up a wheel in case of a broken axle or wheel center, is not an impossible job out on the road if you have plenty of chain to hold it and a lever to raise it up where it belongs. If you have no chain, it means lots of work to get the wheel disposed of other ways. When a wheel is slung up, look out that none of the moving parts strike it.

With any driving axle broken, except the back one, you will have no trouble keeping the engine on the rail after blocking up, as the flanges at front and rear will be good. But if the back axle on any type of engine is broken, she is liable to get off, as the next wheel ahead may have a bald tire. To hold her on the rail, pass a chain from the cab casting or step bracket of the engine next the disabled journal across to and fasten it on the corner of the tender next the good flange. This will use the front truck of the tender to hold the rear end of the engine on the rail. It will hold the flange of the rear wheel still in service against the rail. Look out when backing through frogs, as the flange may lead into a point. If you have no chain, use a block of wood as a brace from the engine frame next the good flange on rear wheel across to a convenient spot on the tender frame, lashing the brace with bell cord, so it cannot drop out.

If a tire is broken and comes off the wheel center without doing any other damage, run the wheel center up on a wedge till box comes against the frame, take out the cellar, put a block under the journal that is thick enough to fill up the space between the journal and pedestal binder. This should hold the wheel center up clear of the rail. Also block under the spring or ends of equalizers to take the strain off the block under the journal. With all the strain on the binder, it is not unusual for it to bend down or give way when not of the thimble and through-bolt kind.

You should also block over the good axles and boxes on the disabled side, so engine can't settle down and let the wheel center strike the rail.

Be sure and fasten all blocks so they can't work out. In any case of blocking up make a good job of it at first, so that it will hold the engine up till she gets into the repair shop.

By the way, figure out how you would block up the front driving box on a Brooks mogul with one spring reaching from one front box across to the other one and the equalizer to the pony truck fastened to the middle of this spring.

Quarantined Engine Crew.

Our friend Mr. S. Petrie, of Kahuku, Hawaii, sends us a photograph of a quarantined crew, himself among them, which gives an idea of the engine and car sheds. The plague is still making itself thoroughly respected in Honolulu, and the trains do not run into the city, but stop outside. Mr. Petrie, the one sitting on the bumper beside the conductor, and wearing a black handkerchief around his neck, says they haven't seen the terminal station in two months.

QUARANTINED CREW IN HONOLULU.

Aside from the pump on the guides, the seat sticking out the cab window and the number plate on the dome, it is a very familiar consolidation.

The way an engine stands when she stops after breaking anything connected with a driving wheel, has a good deal to do with the work of blocking up.

If the break is on the right side and the reach rod or reverse lever is pinched so you cannot move her up on wedges, get the blocks and wedges all ready, so when the helper engine comes you can get ready to move with the least possible loss of time.

When an engine comes in with a broken axle, make it a point to get around right off and examine her. Find out what damage was done when the axle broke and what else was disabled before the engine was stopped, just how the blocking up was done, etc. You will then be loaded with good ideas when your turn comes to take care of such a disability.

It seems rather strange to hear of occasional returns to iron for piston rods after using steel, but we occasionally run across cases of this kind. A shop we recently visited was working up old iron axles for piston rods to replace broken ones. It looks as though our friends in the steel business hadn't got through all of their missionary work yet. This should be a chance for nickel steel to show its superiority.

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Some Peculiarities About Water.

To the average mind nothing in nature could be purer than the clear limpid water from the bubbling brook or from the crystal spring; but sad reality has found out that the same representative of purity frequently carries a load of impurities that seems incredible to those who are not familiar with water analysis. All water has passed at some time through Nature's great distillery, the atmosphere, and it has hovered over the earth in clouds, finally to descend in the form of rain or snow. When first distilled, the water would be pure, consisting of H_2O, as chemists write it, which means two atoms of hydrogen and one of oxygen. Nothing else is needed to make the compound that forms pure water; but no sooner does the vapor start floating in the atmosphere than it begins to gather up impurities. There is a little carbon dioxide mixed with the atmosphere, and the water vapor takes up more or less of it, and it also absorbs traces of nitrates and other foreign elements that are found in the air. The carbon dioxide is the gas mixed with the air that feeds vegetation with building-up material, and it is also the product of the combustion of all carbon substances. Water itself is the most universal solvent in nature, but when it becomes mixed with carbonic acid its action in melting rocks is greatly accelerated. We are familiar with the expression "A drop of water will wear away a stone." That is what water is doing all the time, and the stones melted and incorporated with the water come back in the form of scale to torture boiler users.

Water possesses the power of dissolving many solid, liquid and gaseous substances. This solvent power varies with different substances, and with different temperatures. Thus, a pound of cold water will dissolve 2 pounds of sugar, while it will only take up 6 ounces of common salt, 2 of alum, or 8 grains of lime. Heat generally increases the solvent power of water; thus boiling water will dissolve seventeen times as much saltpeter as ice-water. But there are exceptions to this rule; ice-water dissolves twice as much lime as boiling water. A solid substance will dissolve faster if powdered than when in a lump, because in the former case the solvent has more surface to act on. Stirring also hastens solution, by bringing portions of the liquid not yet saturated in contact with the solid substance. A saturated solution is one which has taken up all of the substance to be dissolved that it will hold. Such a solution may still be capable of taking up a quantity of a different substance.

Liquids which will mix with water, as alcohol, are said to be soluble in it. The liquid of which the larger quantity is present is generally spoken of as the solvent. Water dissolves gases in the most diverse proportions, taking up, at the freezing point more than a thousand times its bulk of ammonia, about twice its bulk of carbon dioxide, one twenty-fifth its bulk of oxygen and scarcely one-fiftieth its bulk of hydrogen. There is, therefore, an atmosphere diffused throughout all natural waters, which is richer in oxygen than common air, and hence better adapted for supporting the life of aquatic animals.

The gases absorbed by water give it a brisk, agreeable flavor, and, if driven off by boiling, the liquid becomes insipid. The solubility of gases in liquids increases as the temperature decreases; it also increases with pressure.

Limestone is one of three species of rocks that make up the greater part of the earth's crust, and America has received a good share of the lime distribution. During the stupendous operations of Nature in building up this continent, the rocks have been subjected to vast disintegrating agencies. They have been torn and eroded by huge masses of ice; they have been burned by the rays of the unshadowed sun, fractured by the congealing power resulting from deep-searching frost, then pounded and scattered by floods. The process of scattering has been so complete that in the whole limestone territory all the earth is charged with lime and great quantities of the material have been carried into districts where no limestone formations are to be found. Owing to this there are few streams and fewer wells throughout a great part of this continent that are not contaminated with lime. The water that passes into streams generally runs over surfaces that have been washed partly free from lime; and in consequence of this, creeks and rivers are not so badly tainted with lime salt as the water in wells that stands saturating among the rocks. The appearance or taste of water gives no indication of the quantity of lime or magnesia held in solution, for expensive experience has proved that many a crystal spring and deep-driven well that provide delicious drinking water yield at the same time so much solid substances as to be ruinous as boiler feed water.

The most abundant mineral in the ocean is common salt; yet sea water contains traces of nearly every element found on the earth. Boiler users on land suffer most from the impurities lime and magnesia that are so plentiful and dissolve so readily in water. Some combinations of iron, sulphur, soda, potash and common salt are found in water in sufficient quantities to sometimes cause trouble, but their bad effects are small compared to those of lime and magnesia. Both the latter two minerals deposit scale that is different in quality and in the injury it is likely to effect on boiler sheets. The most common scale is carbonate of lime or magnesia, and the most destructive is sulphate of lime or magnesia. The carbonates are held in solution in the water by carbonic acid and the sulphates by sulphuric acid. The scale forming compounds are sometimes held in solution in the water in the form of bicarbonates or free carbonates. When that is the case, boiling will precipitate the portion of lime salts held in that way. It is lime held in the water by that means which can be taken out by certain kinds of water heaters. No heat treatment short of evaporation will take ordinary carbonate and sulphate of lime out of the water, but they can be precipitated by chemical compounds for which their elements have an affinity. It is difficult without analysis to tell the difference between scale formed from carbonate of lime and sulphate of lime; but experience has proved that the latter scale is much more effectual than the former in preventing the prompt transmission of heat from furnace and flues to the water, and consequently it is more destructive to the heating surface. The scale formed by iron and the compounds associated with it generally make a thin, tenacious scale that has a corrosive effect. Iron salts in the feed water nearly always indicate the presence of acids which sometimes attack boiler and flues, causing pitting and other corrosive manifestations.

The evils resulting from scale-forming impurities in feed water have no doubt caused annoyance ever since steam boilers came into use; but the destructive effects of boiler scale were never properly realized until high steam pressures came into vogue. There were no doubt numerous personal and isolated efforts made by boiler users to neutralize the scale forming ingredients in feed water; but no co-operative and systematic attempt was made to cope with the evil until the American Railway Master Mechanics' Association appointed a committee to investigate the subject. The importance attached to the question may be inferred from the fact that the committee reported at the second convention, held in 1869. A large proportion of the railroads represented were doing something to remove or prevent the formation of scale, the principal means employed being various anti-incrustation compounds. Among the remedies were galvanic batteries, potatoes, tallow, zinc, cotton seed oil cake, bran and a powerful pump for washing out the boilers. We believe that the pump was the most efficient remedy, but there was a despondent tone upon the subject of boiler scale, and the opinion prevailed that the only way to prevent scale was to purify the water before it went into the boiler.

Nearly every succeeding convention found the master mechanics investigating and discussing the boiler scale question, sometimes hopefully, but generally with a despairing tone. Very exhaustive trials had been made with chemicals to neutralize the feed water impurities, and the conclusion arrived at was expressed in a paragraph by a committee of which Mr. E. T. Jeffery, now president of the Denver & Rio Grande was chairman. The report said: "The impurities held in solution and suspension in water differ widely in different localities, and what may affect the incrustation for one kind of water will not affect that for another. In fact, it appears that the incrustations taken from the boilers differ in component parts according to the locality from which they were removed." This was a confession that no all-round remedy could be found for hard feed water. It was necessary to treat every water station according to the ingredients found in the water. That committee strongly urged that care be taken in locating water stations to secure soft water if possible.

We would recommend the conclusion of this committee to the railroad companies that regularly mix soda ash with their feed water for the purpose of neutralizing the scale-making elements. We know that soda ash, which is carbonate of soda, will help water containing sulphate of lime or magnesia, since the sulphuric acid will desert the lime for soda the stronger base, but we cannot see anything but harm in putting soda into water containing carbonate of lime, for if a chemical reaction takes place, which is unlikely, the carbonate in the lime and the carbonate in the soda would merely change places. The proper way to precipitate lime carbonates is by adding to the water the proper equivalent of lime water. The indiscriminate mixture of soda with boiler water is merely adding to the volume of impurities.

Sharp Wheel Flanges.

When a practical man meets with any difficulty in his business, it is natural that he should inquire around to find out if other people engaged in the same business have overcome the difficulty that is causing him embarrassment. This is why we have so many puzzling inquiries sent to our Question and Answer department, and this is why some railroad man is always asking for information about the cause of sharp flanges of car wheels. We do not remember a time when two or three years elapsed that there was no public discussion of the cause of sharp flanges. The epidemic of discussion is pervading the land again, and we may expect to hear all the old facts, fancies and theories ventilated with more or less volubility and variety.

So far as cast-iron wheels are concerned, the cause of uneven flange wear is nearly always due to wheels of uneven circumference being placed upon one axle. The prevalence of cut flanges always increases with increase of business, and more especially when railroad companies are demanding new cars to be delivered as fast as contract shops can turn them out. When business is quiet and railroad companies can afford to wait for new cars till they are built under careful inspection, there is likely to be ordinary care exercised in the matching of wheels, and so the complaints from flange cutting are comparatively rare; but when shops are pushed to their full capacity to fill orders for cars, the inspector receives little attention, and firm protests against loose methods are likely enough to result in his recall.

Those who have watched the workmen in contract car-building shops matching the wheels that are going to be running mates, are not surprised that there is flange cutting due to the wheels varying in circumference. The surprise is that the extent of flange cutting from that cause is so limited. A good authority on car-wheel matters has lately made a public statement to the effect that the average cast-iron car wheel is ⅛ inch out of round. When a workman takes the diameter of wheels as a measurement for matching, it is not surprising that odd sizes go together.

Besides unevenly matched wheels there are a variety of other causes for flange cutting. Trucks out of square make wheels run to one side, and car bodies bearing on the sides of the truck sometimes start flange cutting that brings a wheel prematurely out of service. We have seen a new brake shoe with chilled edges which were pushed into the flange by a badly adjusted head make quick havoc on a wheel flange. Rails made with no filet to speak of have been blamed for causing wheel flange cutting. There are other causes for this malady, but all of them put together are not so destructive as the action of badly matched wheels.

Railroad men need not, however, wax melancholy over the prevalence of sharp wheel flanges. The trouble is more apparent than real. Many cars with sound wheels pass through a station before one comes along with badly cut flanges. The increasing loads that cars have to carry is doubtless increasing the effects of the destructive agencies that sharpen wheel flanges, but still the number of wheels that have to be removed for cut flanges are few compared to those removed for other causes. When considering the best form of rail head several years ago, a committee of the American Society of Civil Engineers investigated the extent of wheel flange cutting, and they found that less than 3 per cent. of the wheels removed were taken out on account of flange wear. We are inclined to think that the percentage is no greater to-day, for wheels run over better tracks than they did twelve years ago.

Foolish Stories of Railroad Life.

The heroics of railroad life form one of the very best subjects for modern romance, but they need to be handled by a master hand, who has accurate knowledge of railroad affairs as well as imagination. The proprietors of several magazines have in the last few years attempted to regale their readers with railroad stories; but, as a rule, they have made the most ridiculous kind of a failure. In this respect McClure's Magazine has been particularly conspicuous.

When writers of romances take any special subject on which to make the foundation of a story, art demands that they shall make their pictures free from blunders of fact or of history. Great ridicule was once heaped upon a story by a French writer who made a personage run from the Tower of London to Buckingham Palace in ten minutes, the distance being about seven miles. That is a legitimate matter of criticism, and so is a ridiculous statement made in a railroad story.

We once read a railroad story where a meek and lowly, innocent horse thief was making his escape from the minions of the law. He found a locomotive standing upon a side track and used the engine to carry him away from his pursuers. He had never been in the cab of a locomotive before, but by some instinct bright he operated the different handles and levers to make the machine move along the track like a thing of life, fire and water being supplied to it as if by magic. Very much in line with that yarn is a story which appears in McClure's Magazine for February called "A Million-Dollar Freight Train." In that story an ignorant, inexperienced wiper takes a locomotive and pulls a fast freight train under tremendously trying circumstances that would have puzzled a veteran engineer. The skill and knowledge that come to the engineer by long experience were supposed to come to this wiper by inspiration. Statements of that kind are preposterous absurdities, and have no legitimate place in romance writing.

We offer a few specimen statements for the writers to various magazines, with full confidence that they are not any more ridiculous than the things said nearly every month where railroad life is supposed to be treated. Writers might say: The savage of the plains could stand the injustice no longer, so he sent for a quire of foolscap and wrote an exhaustive statement of his people's wrongs. . . An illiterate trackman just landed learned that the telegraph wires conveyed messages, so he walked into a telegraph office when the operator was absent and sent a message to the superintendent demanding a raise of pay. . . The captain and chief officer of the vessel were struck dead on the bridge by lightning, and a tailor who was a stowaway took their place and navigated the vessel half round the world. . . The cook of the yacht went crazy with delirium tremens, and an editor on board took the cook's place and filled it satisfactorily, although he had never tried to mix mush before.

Ordinary people would tell the tellers of such tales to tell them to the marines; yet it is just analogous absurdities that are spun through McClure's Magazine, and some other publications, as railroad stories. We understand that the publishers of that magazine solicit subscriptions from railroad men on the pretense that especial attention is given to railroad subjects. It is a case where the claim ought to be very mildly drawn. Railroad men do not need to be told when a story teller makes them appear ridiculous.

Deficient Grate Openings.

Nearly all railroads in the world are striving to produce locomotives with great steam-generating capacity, and very awkward designs of fireboxes are frequently put in service, with the view of burning an immense quantity of coal. Of course it is from burning a great deal of coal that a large volume of steam per hour will be produced, but we think that sometimes blunders in details are made which render fast steam-making expensive. The tendency is to provide enormous grate area, a surface frequently so long that good firing is beyond human possibility. If a fireman cannot throw coal with ease upon any part of the grate, there will be loss of heat all the time from openings in the fire that admit cold air to pass through and lead to fuel gases passing away unconsumed. Some designers consider that details of this kind are unworthy of attention, but they have much more important effect on economical steam-making than others that are supposed to involve skillful scheming.

Another thing that receives too little attention is the form of grates. Grates ought to be made with as large a percentage of opening as possible consistent with the necessary strength to carry the load of the fire, but grates are frequently made in a way that indicates that the designer had no idea that air had to pass through the openings to sustain combustion. When an engine is not steaming freely there is an inclination to experiment with the draft appliances, changing position of diaphragm plate, altering the nozzles and experimenting with the smokestack, when all the time the only thing at fault is the grates which do not admit enough air. This is a hint worth taking a note of.

Safety Train Appliances in Mexico.

The Mexican Government has ordered that the railroads in that country shall use substantially the same safety appliances on their rolling stock that will soon be compulsory in the United States under the Safety Appliances law. Such railroads as the Mexican Central have very little change to make, for it has been for years the policy of the management to keep abreast of American practice, but some of the railroads will have to make very expensive changes. On some Mexican railways link and pin couplers are still used on passenger cars, but these must all be changed for the Miller hook or the M. C. B. form of coupler.

The Government of Mexico is like that of Russia in the power it possesses to make peremptory laws for the safety of trainmen and other citizens. There is no hanging back till the time for making the changes comes about, and then making representations that more time is necessary. The order is issued, and those who are not ready to comply with the law when it goes into effect find their health in jeopardy.

Heated Air for Steam Making.

A paragraph in a recent report submitted to a railroad club says: "Authorities on combustion seem to agree that steam is not a good thing to introduce in the fire, and that in introducing air, as under an induced jet, there is no real combination unless the air is heated up to about the temperature of the gases in the firebox."

That is all nonsense. It is just as well to say that there is no combustion with the cold air admitted through grates. It does not matter in what condition air is admitted to the fire. It will induce combustion unless it is put in in such great quantities that the temperature is lowered beneath the igniting point. We hear a great deal about the advantage of heating air for combustion up to the temperature of the gases. No doubt it would be a good thing to do if superfluous heat could be used for the purpose, but to merely use direct heat for heating the air would just be senseless waste, so far as steam-making is concerned. There are metallurgical operations where the use of heated gases is a great advantage in combustion, but that is because a very high temperature is necessary for the operations to be performed. This is not necessary in the generation of steam.

Keep in Touch With Your Employés.

When C. P. Huntington was in Galveston, Texas, a short time ago, he was discussing the matter of the large railway corporations absorbing the smaller ones, the particular case being the purchase of some of the smaller railroads running into Galveston. He said that these consolidations reduced the force of the higher grade of the officials, but did not in any way affect the number of the men employed lower down. The executive expenses were materially reduced so the road would have more net earnings, which was better for the employés all around.

We will grant that the consolidation of the executive departments of the small roads into the large systems reduces the force at the top and not down in the ranks, but it affects the employés in another way—it puts the executive head a great deal farther away from the men in the ranks. On the small road the general manager or superintendent can be, if he so desires personally acquainted with his men and better able to do his best both with them and for them.

An officer that can be in close touch with his employés as an executive is more valuable than one who only carries out general orders issued from the head office, which are not always flexible enough to suit particular divisions and thus operate smoothly for all.

Painting Wing Fences.

The Commissioner of Railroads for Michigan, in his last annual report recommends that a law be passed requiring railroad companies to paint all wing fences at highway crossings white, in order to furnish the best background possible to distinguish objects on or near the crossing. All locomotive engineers agree that they are greatly assisted when fences are thus painted, not only in locating the crossings when approaching them, but also in determining whether there are any persons, teams or animals inside the right of way limits which may go on the crossing. This is true both in daytime and night.

The Commissioner also takes up the question of danger to train men from overhead wires that cross the tracks. On the 10,211 miles of track in the State there have been 7,000 crossings inspected during the past summer; 5,000 of them were pronounced defective in construction. More than 500 were exceedingly dangerous, and orders were at once issued to place all dangerous points in a safe condition, which orders were obeyed.

We do not know just how the Commissioners of other States look after the matter of wires that are close enough to the tracks so that trainmen on top of cars are liable to be caught by them. In the case of a naked trolley wire striking a man when standing on a wet car it might mean death. Any wire that was low enough to catch a man would certainly drag him off the top of the train, possibly to his death.

A Memorial Volume.

"Memoir of Hayward Augustus Harvey" is the title of a neat volume written and published by his sons. After giving a little family history, with portraits, it tells of their father's work in mechanical lines. It gives his work in getting out the rolled thread screw. His claims of priority in this are supported by Mr. Angell, president of the American Screw Company, and others. The name of Harvey is, however, best known in connection with Harveyized steel plates for battleship armor, which are being largely used for this purpose all over the world. The book is interesting as a contribution to the history of steel working, as it shows the furnaces used and the results of tests made on the first plates.

Through the kindness of Mr. Theo. C. Beake, we have received a very interesting and now curious book, called "The Locomotive Engine Popularly Explained," by William Templeton, published in London in 1841. The construction of the engine is explained in a very elementary fashion, every detail being described and the method of operating dilated upon. There are also numerous calculations of strength of parts, etc., which the pioneer engineer was expected to work out. The duties of engineers and firemen are also clearly explained. The book was a master work of the kind in 1841.

We have received from Nashville, Tenn., a long letter, written on Louisville & Nashville Railroad paper and signed "Subscribers and Readers," containing an attack on Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville, and on Mr. Roberts, master mechanic of the same road, for the position they have taken regarding smokeless firing. We are not hankering after more letters on that question, but if we were anxious to have more discussion upon it, the letter from "Subscribers and Readers" in Nashville would go direct to the waste-basket. The writer of the letter must be very deficient in observing faculties when he fails to know that Locomotive Engineering does not publish anonymous letters. If a correspondent lacks the manliness to sign his name to his letters, it presents the best kind of argument against publishing them.

Mr. George A. Burt, vice-president of the Ohio River Railroad, contributed an article to the *Engineering Magazine* on the relative merits of the Panama Canal and of the Nicaragua Canal routes. The article makes a fair engineering statement, which will appeal favorably to everybody except the politicians who are promoting the Nicaraguan scheme. The article says that the Panama Canal is 46 miles from ocean to ocean, while the other is 174 miles. Twenty-nine miles of the Panama Canal is excavated channel and 49 miles in the Nicaraguan Canal. It is estimated that it would cost $69,924,000 to finish the Panama Canal and $133,473,000 to finish the Nicaraguan Canal. The time and cost of operating are largely in favor of the Panama route. The only weak point about the latter scheme is that all the political pulls seem to be on the other side. Pulls and pickings go together.

The American forests are fast disappearing, and the making of crossties for railroad track is responsible for the rapidity with which many forests are getting cleared of their timber. The time is not far distant when steel will take the place of wood for railroad ties. It is merely a matter of price that will bring the steel crossties generally into service. The making of steel crossties is no experiment, for there are thousands of miles of railroads in different parts of the world where steel crossties are exclusively used. The most successful steel tie is made in the form of an inverted trough, with very simple fastenings for the rails and a hump in the middle which prevents the tie from moving laterally. That form is made under a press and costs very little for labor.

A great many railroad companies in the South are equipping their locomotives with electric headlights. The engineers, while dubious about them at first, are now soliciting the master mechanics to put electric headlights on their engines. That form of headlight will soon be as popular as the injector has become, although both met with much opposition from enginemen at first.

Experiments at the Norfolk Navy Yard with oil as fuel for warships have seriously disappointed the expectations of those who proposed them. It is the opinion of experts that the use of oil for such purposes would not be at all economical, inasmuch as its general adoption would be followed by a prompt increase in cost, and, moreover, while fuel of that character might be valuable on torpedo boats when it is desired to raise steam in a hurry, the tests thus far have not shown that it would be available for naval vessels of other types. In a word, the engineers in charge of these experiments have yet to be convinced that oil can be substituted for coal as fuel for vessels of modern construction.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(45) L. W., Xenia, Ohio:

If I had a broken valve yoke could I block valve centrally over ports by taking out the release valve and using a piece of pick handle or a broomstick and replacing release valve? A.—The valve might be secured by that means, but we are inclined to doubt it.

(46) D. H. S., Greeley, Colo., writes:

When reverse lever is put in center notch do valves move enough to admit steam to cylinders, and should valves move at all with lever in center notch if link motion is properly constructed? A.—The valve will move a distance equal to double the angular advance of the eccentric. It will move enough to admit steam.

(47) J. P. K., Bloomington, Ill., writes:

How much of the circumference of the steam ports in the bushing of a piston valve can be figured on as actual steam port—the whole circumference, a little less than the whole circumference, or an amount equal to the diameter of the bushing? A.—A little less than the whole circumference. There is a diversity of opinion about how much.

(48) M. A. V., Newburg, Mo., writes:

Please explain in Locomotive Engineering which will cause a locomotive to burn the least fuel—to increase the lead or to decrease the lead, and please explain why? A.—That will depend on circumstances. If the valve motion is so designed that the lead increases very much as the lever is hooked back, decreasing the lead will decrease the amount of fuel used.

(49) W. A. R., St. Louis, writes:

How much water a mile will an engine use with 20-inch cylinder, diameter of wheel outside of tire 5 feet, steam pressure on boiler 175 pounds, worked in a 9-inch cut-off with wide open throttle? A.—Assuming that the piston and valves are steam tight, we find by calculation that 2,200 cubic feet of steam will be used, which represents about 105 gallons, or 874 pounds.

(50) I. K., Saginaw, Mich., writes:

If foaming of a boiler can be stopped by mixing blue vitriol with the water, please explain the reason why? A.—Blue vitriol is an acid, and will neutralize the soapy substances that generally cause foaming. Blue vitriol might be used as a temporary remedy for foaming, but it is a risky thing to put in a boiler, being sulphate of copper. Under certain circumstances the sulphuric acid in the substance will attack the boiler sheets.

(51) J. G. R., North Tonawanda, N. Y., writes:

I beg to ask of you a few questions in regard to injectors. I have an engine that has on it two Freedman injectors; viz., one a No. 7 and one a No. 8. I have had trouble for the last two years with checks. The left-hand, or No. 7, is a globe-shaped check valve, and it sticks up every time the injector is worked. The right-hand, or No. 8, check will leak very badly about two or three days after it has been ground in. A.—The trouble evidently is caused by incrustation. The globe valve evidently needs to be renewed.

(52) W. B. W., Waltham, Mass., writes:

1. What are the indications that a driving wheel tire is loose? A.—1. Oil will generally be seen oozing out between center and tire. 2. Does the tire of a tender wheel become loose; if so, what are the indications of same? A.—2. Yes; same indications as for driving wheel. 3. What is the thinnest driving wheel tire that may be safely run under high speed, passenger (60 miles per hour), and under freight (40 miles per hour) engines? What is the thinnest tire safe for tender wheels? A.—3. Opinions differ. From 1½ to 1¼ inches.

(53) H. M. A., Chicago, writes:

1. In the event of a valve yoke or valve stem becoming broken inside of steam chest, how can the breakage be located? 2. After having determined on which side the defect is, how can engine be put in safe running order? 3. Could valve be blocked without raising steam chest cover, as in case with a large freight engine? 4. What can and should be done in case of a broken eccentric strap or blade? 5. What can be done in case a link saddle pin should break? A.—All these questions are answered in the answers to traveling engineers' examination questions in the 1899 edition of "Sinclair's Locomotive Engine Running."

(54) C. M. Mc., West Milwaukee, Wis., writes:

One of our engineers running a Baldwin Vauclain compound broke a go-ahead eccentric blade. All he did was to take off the broken parts, and then he backed the engine up 19 miles to Milwaukee. Then he went ahead ¼ mile on turntable and into the house head first. What risk did he run in running the engine in that condition, and how is it the engine would go ahead? There was no damage done that I know of. A.—The only danger he ran was of jamming the link, which would have caused trouble. With that form of compound the cylinders with intact connections would have sufficient power to overcome the back pressure of the other cylinders.

(55) J. M., Braddock, Pa., writes:

We have a Baldwin saddle type locomotive and we have had trouble with the throttle valve ever since we had her. We have ground valve in six or seven times, and also have taken throttle box off and found nothing wrong and the valve seats perfect. The strange thing about it is, sometimes for two or three days after we grind in the valve it don't leak much, then it will start. I got men out of the shop who worked for years on locomotives to try their hand on it, and in a few days it would be just the same. Another thing about it is, she slobbers herself with two gages of water. Please give your reasons through LOCOMOTIVE ENGINEERING, and oblige? A.—This is due to the uneven expansion of the valve box. It is of a different shape when hot from what it is when cold.

particularly favorable for this high-class transportation, and the vehicles can in safety reach a speed from 10 to 14 miles an hour on any of the streets, excepting in the business portion.

It has been arranged, when special service is desired, passengers on trains approaching Washington from the East will notify conductor before arrival at Baltimore, and on trains from the West will notify conductor before arrival of train at Washington Junction.

The rates for this extraordinary service are extremely reasonable, and the Baltimore & Ohio Railroad, with its advanced ideas and methods, is to be congratulated in being the first to inaugurate regularly this latest invention in transportation service.

BALTIMORE & OHIO AUTOMOBILE PASSING CAPITOL AT WASHINGTON.

B. & O. Automobile Service.

The Baltimore & Ohio Railroad has established electric automobile service at Washington, D. C., in connection with its train service, being the first railroad to introduce this mode of transportation regularly to and from its railway station. Our illustration shows one of these automobiles passing the Capitol at Washington.

The automobiles are of the latest electric pattern, absolutely noiseless in regard to machinery and running gear. They are provided with luxuriously deep-cushioned seats, with electric lights and time-pieces. Two small trunks can be carried on the supports at the rear of the vehicle, and the top of the cab provides ample room for small traveling bags and hand luggage.

The splendid streets of Washington are

Among meetings of railroad men we hear so much admiration expressed for Skinny Skeevers and his object lessons that we wax melancholy because Skinny has retired from business. The only thing that cheers us is to take up the bound volume of the Skeevers articles and read a few of them over again. They always seem as fresh as the day they appeared. People suffering from a tired feeling, with an aching void waiting to be filled, should send to this office for the book, which costs only one dollar.

Economical Operation of Locomotive Injectors.

BY JOHN W. TROY.

In reply to Mr. E. W. Pratt's question on page 109 of the March issue of LOCOMOTIVE ENGINEERING, as to why a locomotive boiler will steam better if the supply of steam to the injector is cut down at the steam valve on the boiler head, so as to just keep the injector working, and take up the water, thus using less steam and delivering the water at a lower temperature, I might say, that the boiler will steam better, because the water goes into the boiler up near the front flue sheet, and thus takes more heat out of the gases flowing through the flues into the smoke arch.

As the heat after passing into the smoke arch is lost, as far as the water in the boiler is concerned, and water at a temperature of 120 degrees will absorb more heat from the flues than if it is at 220 degrees, therefore it follows that this water can be more economically heated at this part of the boiler than by live steam direct from the boiler.

This is a theory, and the theorists will attack this end of the argument first. But there are facts that are not theories in connection with free-steaming locomotive boilers.

If one engine uses less steam to do the same work than another, the first one is a good steamer and the second one may be a poor one when both boilers are doing the same work in evaporating water. The fault lies with the engines which use the steam, not with the boiler that makes it. When one locomotive that is a poor steamer uses more than the usual proportion of water for doing the work, if there are no leaks, it is fair to assume that the cylinders and valve motion are wasting the steam.

Now, the less steam taken to do the work the better steamer the locomotive will be. This applies to the work of the injector, just as well as to the work of the cylinders, the air pump, the steam-heating system or any consumer of steam from the boiler. Therefore, the less steam used by the injector in doing the work of supplying the boiler, the better the boiler will steam.

Another way to put it is this: If you take a light train which a 16 x 24-inch engine can handle easily and economically, and put an 18 x 24-inch engine on the run, the 18-inch engine will do the work easier every way; but at the end of the month the account will show that the 18-inch engine cost more for fuel and water. This is because you use more power than is necessary to do the work. The same applies to an injector; do not use any more live steam—which is the power—than is needed to do the work. An injector just the right size is more economical than one several sizes too large, because the big one uses more power in doing the same work unless worked to full capacity.

Another reason: It is a well-known fact among locomotive engineers, that a moderate cut-off and the steam throttled between the boiler and the steam chest is more economical than a short cut-off and a wide-open throttle, when doing the same work with a train. The injector follows the same rule of economical working.

For these various reasons, the successful practical locomotive engineer does not work any more steam through the injector than is needed to do the work properly; just the same as he works the engine, which is with a moderate cut-off and a partially closed throttle.

New Locomotive for Atlanta & West Point R. R.

We have been favored with a photograph of one of the new Rogers ten-wheelers for the Atlanta & West Point and the Western Alabama Railway by the master mechanic, Mr. F. O. Walsh.

They are quite heavy engines and are giving excellent service, having been put into passenger service at once and running perfectly cool ever since. The main dimensions are:

Weight in working order—154,000 pounds, of which 117,000 pounds rest on drivers and 37,000 pounds on the engine truck.

Total wheel-base—23 feet.

Fixed wheel-base—13 feet 2 inches.

Greatest height—15 feet.

Cylinders—20 x 26 inches.

Piston rods—3¾ inches in diameter.

Driving wheel centers—Cast steel, 66 inches in diameter, with 3-inch Krupp steel tire, making 72 inches in all.

Driving boxes—Cast steel, with Ajax bronze bearings.

Eccentrics—Cast steel, lined with babbitt.

Driving wheel journals—8½ x 12 inches.

Boiler—66 inches in diameter at the smallest ring.

Firebox—120 inches long, 39 inches wide.

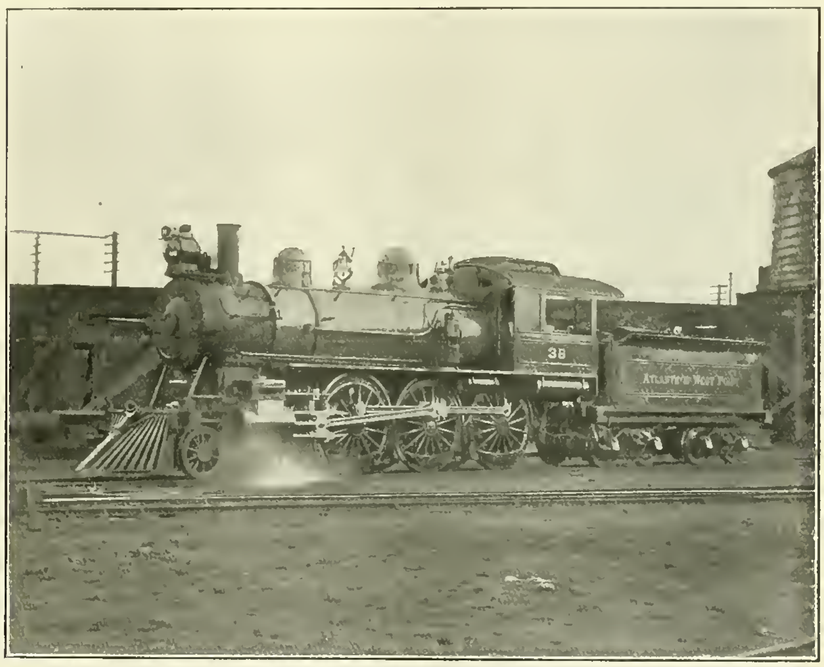
Number of flues—276, 2-inch, 13 feet 2 inches long.

Crown sheet—Radial stayed, 1¼ inches thick.

Working pressure—200 pounds steam.

Tank capacity—4,500 gallons water and 11 tons coal.

Among equipment are: Two No. 10 Monitor injectors; one Nathan triple sight feed lubricator; the Westinghouse and American combination brakes on drivers, tender truck, engine truck and for train; 9½-inch Westinghouse air pump on left side; Richardson valves; Jerome packing in all cases.



ATLANTA & WEST POINT LOCOMOTIVE.

There is a growing use of gas and gasoline engines in railway work as in other industries. This is particularly noticeable in the matter of pumps for water tanks and similar places. The Deming Company of Salem, Ohio, have favored us with a special circular of their railway power pumps, which are driven by gasoline engines. This is interesting in many ways, and it will pay anyone having these in charge to send for one of them.

The Chicago, Lake Shore & Eastern have recently built a new roundhouse at Chicago, and are equipping it with the latest improvements. They have an electric device for turning the turntable and it is highly spoken of by the men.

Steam Consumption of Injector.

BY STRICKLAND L. KNEAS.

In the March issue of LOCOMOTIVE ENGINEERING, a correspondent has brought forward an interesting question that has puzzled many of the higher officials of the motive-power department as well as those who are actually in touch with the problem itself. He asks for a theory to show that a boiler will steam much better if the steam valve [of the injector] be opened not too wide. Among experienced engineers this is known to be a fact; numerous instances have been given the writer where the effect of low steam consumption of an injector has been beneficial to a heavily loaded or badly steaming locomotive, and corroborative evidence is given in the instructive article on injectors in your February number, by Mr. Clinton B. Conger, who, from his wide experience, may certainly speak with authority.

But your correspondent does not question the fact; he asks a satisfactory theory. Unfortunately, little is known regarding the circulation of water or the distribution of temperatures in a locomotive boiler; therefore the following theory is offered tentatively:

Throttling the steam supply of an injector reduces the volume of steam taken out of the boiler and lowers the delivery temperature; as throttling superheats, the desired result can be obtained better by using the smallest steam nozzle in the injector that will force the desired quantity of water into the boiler, and this is a mark of efficient design. Superheating also complicates the question unnecessarily, so that to simplify the calculation, the direct and indirect effect of feeding with two types of injector will be considered; injector A, giving high mechanical efficiency of fluid motion, using a small amount of steam for feeding, and delivering into the boiler at a low temperature; and B representing the class of injectors with high steam consumption and very hot delivery. Injector A delivers water into boiler at 154 degrees; injector B delivers water into boiler at 263 degrees. Injector A, every pound weight of steam forces 10.42 pounds of water into boiler; injector B, every pound weight of steam forces 4.56 pounds of water into boiler. Boiler pressure, 200 pounds. Temperature of water supply, 50 degrees. Each injector supposed to take 1,000 pounds of water from tank. Four distinctive cases will be discussed—(a), (b), (c) and (d).

(a) Assume purely theoretical conditions; feed constant; constant load on engine; constant temperature of firebox and gases in the tubes. To deliver the required 1,000 pounds from the tank, injector A takes 95.9 pounds of steam out of boiler; injector B takes 219.5 pounds of steam out of boiler. To vaporize these weights of steam from and at 387.8 degrees, the temperature of the steam for injector A requires 10.1 pounds of coal; injector B requires 23 pounds of coal (8,000 heat units per pound of coal). And to raise the water and condensed steam delivered by A and B to the temperature of the steam, the weight of coal required is: A, 32.7 pounds, and total coal required, 10.1 + 32.7 = 42.8 pounds; B, 19.8 pounds, and total coal required, 23 + 19.8 = 42.8 pounds; showing the same amount of fuel for A and B, under the conditions assumed, unless the evaporative efficiency of the boiler is increased by the use of injector A. This point will be discussed under (d).

(b) Assume the boiler to evaporate at its full capacity just sufficient steam to supply the cylinders at 8 inches, or one-third cut-off, and maintain steam pressure of 200 pounds. The effect of starting the injector will be to reduce the pressure. During the delivery of 1,000 pounds of water the volume of steam used is: Injector A, 205.4 cubic feet (corresponding to about 100 horse-power); injector B, 459.7 cubic feet (corresponding to about 233 horse-power), and after the delivery of 1,000 pounds water, the steam pressure will be reduced to: When using injector A, 181 pounds boiler pressure (approximately); when using injector B, 161 pounds boiler pressure (approximately). This loss of pressure lowers the mean effective pressure, unless the cut-off be lengthened; the latter increases the steam consumption and reduces the cylinder efficiency: Injector A, cut-off lengthened to .375, requiring 12½ per cent. more steam; injector B, cut-off lengthened to .45, requiring 36 per cent. more steam.

To use the injectors without loss of boiler pressure, the evaporative power of the boiler must exceed the requirements of the cylinders in the following ratios:

Injector A = 9½ per cent.,
Injector B = 22 "

It should also be considered in this connection that the efficiency of any boiler does not increase indefinitely; if pressed beyond the point of maximum efficiency, fuel is wasted. Unless there is unusual reserve power, the additional evaporation of 22 per cent. to supply injector B will in most cases not only press the boiler beyond its most efficient point, but also reduce the steam pressure and the mean effective pressure in the cylinders.

(c) Constant conditions in almost all operations make for economy. In boiler practice, it is the frequent change from light to heavy firing, due to wide variations in the amount of steam used, that is responsible for most of the fuel loss. Let us consider not only the effect of feeding with the two injectors, but also the subsequent drain on the fire required to raise the temperature of the delivered water to that of the steam. The injector which maintains the fire more nearly constant must produce the most satisfactory results from the boiler.

When the feed is started, the immediate effect is to reduce the pressure, unless an added quantity of fuel is burned. During the time the injector is running, it is probable that more coal is required than the calculation showed under heading (a), where the conditions assumed were purely theoretical, because the entering water at once receives heat from the tubes and the surrounding water. It is therefore more nearly in accordance with actual conditions to take the following weights for: Injector A, 11 pounds of coal required to supply steam while feeding 1,000 pounds of water; injector B, 25.5 pounds of coal required to supply steam while feeding 1,000 pounds of water.

When the injector is shut off, the feed water must be brought up to the temperature of the steam. Now, injector A has used so little steam and required so little change in the fire, that the heat now required by the feed is about the same as was used to evaporate the steam. On the other hand, the delivery of injector B is so hot that, with the heat transmitted through the tubes, it is now almost at steam temperature; the fire must therefore be strongly checked to prevent popping at the safety valve. The approximate temperatures may be assumed to show a much greater gain for the A injector than the B, because the delivery of the former being so much lower, more heat will be absorbed from the flues and the surrounding water. Although the actual difference between the delivery temperatures of the two injectors is 109 degrees, yet, after 1,000 pounds has been delivered, the difference will probably be reduced to about 40 degrees. Assuming that when the injectors are shut off the average amount of heat in the delivery of the two injectors, reduced to degrees Fahr., is:

Injector A = 300 degrees,
" B = 340 "

the weight of coal required to raise the total delivery to 387 degrees requires: For injector A, 11 pounds of coal (no checking the fire required); for injector B, 7 pounds of coal (fire must be checked to prevent popping at the safety valve). The injector A tends to maintain more even drain on fire than injector B.

(d) The last theorem is, that the evaporative efficiency of the boiler is increased by the abstraction of a larger quantity of heat from the waste gases entering the smokebox by the colder delivered water of injector A. The transmission of heat through thin plates or tubes is almost proportional to the difference in temperature between the fluids on opposite sides of the interposing walls. It has been shown by numerous experiments that the evaporation from the flues is less than 50 per cent. of that of the firebox. If the length of the boiler be divided into five equal parts, the part adjoining the smokebox evaporates only 5.6 per cent. of the total; the next part, 8.2 per cent.; the third, 12.2 per cent.; the fourth, 23.7 per cent.; and the firebox end, 50.3 per cent. Any increase of evaporation from the front end causes a reduction of the temperature of the waste gases and an increase in the steaming power of the boiler. The delivery temperature of injector A is 154 degrees, and injector B 263 degrees, and the theoretical rate of the transfer of heat is:

Injector A $\propto$ .846 = rapidity of transfer of heat,

Injector B $\propto$ .737 = rapidity of transfer of heat,

and the relative advantage of injector A over B is in proportion to these values, or

Local gain due to injector A = 14 per cent.

This does not refer to the total evaporation of the boiler, but only the small part of boiler at which such low temperatures exist, probably at or near the front end. If the temperature of the water in different parts of the boiler could be determined or calculated with any degree of certainty, some reasonably accurate conclusion might be drawn; as the water is delivered near the front end directly on the flues, it is probable that the two front sections are benefited, and the gain would be 14 per cent. of (8.2 + 5.6); or, total increase of evaporation due to use of injector A = 1.8 pounds per 100.

In conclusion, it may be said that with the exception of the first case, conditions which can hardly be realized in practice, the advantage seems to be in favor of the injector with low steam consumption and delivery temperature. The data for injector A were obtained from a test of a Sellers improved injector, published in the *Railroad Gazette,* and therefore do not represent a theoretical performance. A further and most practical part of the question about which much might be written is, the judgment shown by the engineer in feeding—using a constant or intermittent feed; delivery temperatures of 153 to 250 degrees—for this plays an important part in the economy of the combined boiler and engine. An injector that is mechanically efficient has a wide range of capacities and can be advantageously used to meet the varying service conditions of gradient and load, but the economy due to method of feeding may be determined only by test, and cannot be treated theoretically

CALEDONIAN RAILWAY OBSERVATION CAR, DESIGNED BY MR. JOHN F. M'INTOSH, LOCOMOTIVE SUPERINTENDENT.

When Mr. Carnegie Was Thirsty.

When Andrew Carnegie was superintendent of the Pittsburgh division of the Pennsylvania he often took inspection trips just to see what was going on. The local freight crews, of course, stopped at Latrobe every day and loaded what seemed to be some innocent-looking milk cans. Of course there was lacteal fluid in some of them, but in several the boys knew that there was a fluid of another color that was intended for the caboose. Well, one day when Andy was at the above named station he became very thirsty, and seeing the local freight nearby, went up to one of the "brakys" and said, "Have you any water to drink?" The "general hustler," replied: "Yep, some back in the caboose, in that milk can." Andy went for that can and came out of the caboose with a great look of satisfaction. He told the "wheel twister" that that was the best water he ever drank, and asked him where they got it. Of course, those living in the vicinity of Latrobe need not be told what it was, but the fact is that it was St. Vincent amber. Every time thereafter when Mr. Carnegie met that crew he asked them if they had any more of that water.—*Pittsburgh Post.*

Coal Washing Plants.

Coal washing has become quite an industry in the Wyoming valley, and the culm piles are beginning to disappear. This not only reclaims otherwise unsalable coal, but returns the land to useful occupation.

The cost of washing is said to vary from 6 to 10 cents per ton, according to conditions. One difficulty, the last summer, has been to get sufficient water, as it takes about 75 gallons per ton. That is 625 pounds of water to 2,000 pounds—not so much as it seems at first sight.

They expect to wash many of the banks in two years, which seems fast work after seeing the extent of them.

In addition to fine tools for machinists, the L. S. Sarrett Company, Athol, Mass., make several specialties for draftsmen, which are being largely used. They include protractors, reading to degrees or finer, section liners for any desired section, T squares and scales for almost any purpose. These tools have the advantage of being accurate and of keeping their shape in all kinds of weather.

Influence of Railway Advertising.

American railway management is always alert and ready to take advantage of every opportunity for extending the commerce of the country, and railway men are among the very first to seize upon each coign of vantage. Within a week from the day that the Paris Peace Commission adjourned, more than one American railway had ordered the re-engraving of its maps to include the West Indies, the Hawaiian Islands and the Philippines. The description of the beauty of our American lakes and valleys, the magnificence of our rivers, the grandeur of our mountains, the fertility of our soil, the wealth of our mineral resources and the superiority of our manufactures, with which our railroad advertising is filled, has been of incalculable value to the export trade of the United States. It has induced thousands of foreigners to visit every section of our country who otherwise would never have come here. It has been the means of the investment in the United States of untold millions of foreign capital. It has been one of the strongest aids to the expansion of American commerce in every direction.—*George H. Daniels.*

Cleanliness on Southern Pacific.

For a road where the freight engines are all pooled and the passenger engines are double crewed, the Southern Pacific Company head the list for neat and clean locomotives.

At Los Angeles the engines are cleaned by the roundhouse force, both above and below the running board. Even the copper delivery pipes from the injectors and boiler checks are kept polished. The wipers look after everything below the running board except the jacket. A few regular cleaners and the front-end man take care of the rest, except the inside of the cab, which the firemen are expected to wipe out. Mr. Sheedy says that the engine crews take just as much pride in the engines they handle as if they did the cleaning themselves, and the company get more work for less expense for fuel and stores out of a clean engine.

It does not take a very large force of cleaners to do this work; neither are the engines held out of service to clean them, so no mileage is lost.

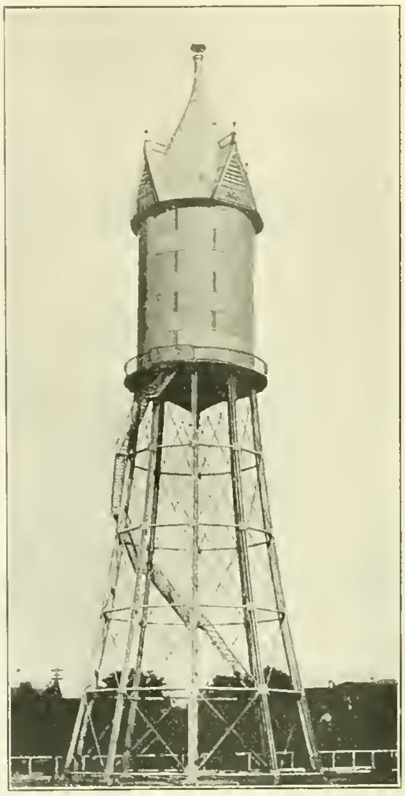
At Kern City it is done the same way, also at Oakland.

At El Paso, Texas, the floors and vise benches are scrubbed clean each week by a gang of Chinamen.

The Santa Fé road is not very far behind in this matter; in fact, west of the Rocky Mountains the condition of locomotives is away ahead of anything in the Eastern and Middle States.

At New Orleans, in the Louisville & Nashville yard, may be found some of the cleanest coach equipment it has been our good fortune to inspect. About 850 to 900 cars are cleaned per month here. The work is in charge of General Foreman D. D. Briggs. Compressed air through a ¼-inch nozzle is first used to clean off the woodwork, cushion backs and floor. The woodwork is then wiped off and the floor mopped last of all. All cushions are taken out of the cars and cleaned with an air blast. The zinc linings around the heaters are all rubbed up bright, which adds to the appearance of the car more than one would imagine. Lamps are taken down at regular intervals, the oil emptied out, oil tubes and wick tubes blown out clean with compressed air, which keeps these tubes clean. The oil which comes out is used in torches. Only a little is thus taken out.

These coaches run through a very dusty country. We do not think any other sections equals it, so a large amount of dust must be removed every trip; but they start out spotless.



LARGEST WATER TOWER IN THE COUNTRY—JACKSONVILLE, FLA.

A Large Water Tower.

The city of Jacksonville, Fla., has a very efficient water supply among its numerous enterprises. Having no natural elevation for a reservoir, it obtains the necessary pressure by the large water tower shown, said to be the largest in the country. As the water tank or tower is a vital problem with many railroads, this has a bearing on the case, showing what has been done in the line of water tanks.

This was built by R. D. Wood & Co., of Philadelphia, at a cost of about $14,000. The foundations consist of ten piers with bases 9 feet square at base and 7½ feet deep. The tower posts are built of four 6-inch "Z" bars and a plate, each post being of five sections a little over 20 feet long. The base of tower is 65 feet in diameter and top 30 feet. Vertical height of tower is 100 feet, while the tank is 30 feet in diameter and 45 feet high, holding 238,000 gallons. The supply pipe is 20 inches in diameter, with an expansion joint at the base of tank.

Railway Run by Children.

A cutting from some exchange says:

"A narrow-gage railroad one mile long is being constructed in Macon, Mo., which will be controlled and operated by children. It is called the Blees Miniature Rapid Transit Road, and it is located in Mrs. F. W. Blees' park. The line starts at the park entrance near the Wabash Railroad, runs by all of the conservatories and around the lake to a dancing pavilion. Each car will carry eight passengers, and will be illuminated at night by colored electric lights. The motive power is to be electricity, and the capitalization of the company is $10,000. Every share has been taken. The officers are: President and motorman, Frederick Blees, aged thirteen years; vice-president, Alvin Blees, aged ten; secretary, Roy Denslow, aged thirteen; treasurer, Willie Blees, aged eight; assistant superintendent, Raymond Kirsch, aged thirteen."

Running a real railroad will be huge fun for the children, but it is a little dangerous means of enjoyment. We have in mind the only son of a rich gentleman, who had a great liking for miniature railroading. Several practical working little steam locomotives were made for his amusement, and he was killed by one of them.

Heavy Engines on the Oregon Short Line.

Reports from the Oregon Short Line engines illustrated in the April issue show that they are doing excellent work. These were designed by the superintendent of motive power, Mr. J. F. Dunn, who writes as follows: "One of the 900 class engines (twelve-wheel) hauled 1,650 to 1,700 tons between Pocatello and Dubois, where the ruling grade is 48 feet to the mile. At Dubois two of the 1000 class (consolidation) couple into this train and push it to Monida, which is over a 2½ per cent. grade (132 feet to the mile). With these engines the trains on this grade have been increased from 825 to 1,650 and 1,680 tons. The engines track well, steam very freely, are light on fuel, run cool and do their work easily."

We have received the fourth edition of the pamphlet on the "Preservation of Wood, Steel and Galvanized Surfaces," issued by the Goheen Manufacturing Company, Canton, Ohio. It is particularly interesting to railroad men.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Seventh Annual Convention of the Air-Brake Association.

The seventh annual convention of the Air-Brake Association, held in Jacksonville, Fla., April 3d, 4th and 5th, was fully in keeping with, if not ahead of, the previous successful meetings. The attendance was large, the papers and discussions were good, and ideal weather prevailed.

President Brodnax called the meeting to order at 9.30 A. M. Tuesday morning. Local speakers were introduced, and the mayor welcomed the convention and members to Jacksonville. President Brodnax's speech was crisp, concise and to the point. He spoke familiarly of the air-brake situation and submitted some valuable advice on the maintenance of air brakes. He reviewed the past work of the Association and prophesied for it a busy and brilliant future.

The paper on "Recommended Practice for the Successful Handling of Passenger and Long Freight Trains" was then read, and proved to be one of the best papers ever presented to the Association. After a full and lengthy discussion the convention accepted the paper, with a special vote of thanks to the committee, and adjourned at 1 o'clock, to meet next morning at 9.

The afternoon was spent by the members and their families in sight-seeing. There were boating parties on the St. Johns River and rides about the city, but the ostrich farm seemed to be the greatest attraction to many. In the evening the negro waiters of the hotel gave a cake-walk, which was well attended by the convention people.

Wednesday's session was characterized by fast, snappy work, two papers being read and discussed. The paper on "Instruction of Employés and Instruction Plants," like its predecessor, was unusually good and exhaustive. Similarly, the paper on "Lubrication of Air-Brake Cylinders" came in for its share of praise. At this session the speakers proved their ability to expedite business by speaking concisely and to the point. Nearly every speaker was on the floor twice or more before the papers were finally accepted. President Brodnax felt that a good day's work had been accomplished when he let the gavel fall for adjournment at 1 o'clock.

In the evening a ball was given in the hotel parlors, and though the weather was quite warm, many of the members and the ladies took part and danced until quite late.

At the Thursday morning session the final paper on "How to Prevent the Ruination of Wheels from Skidding and Flattening" was read and discussed. Then came the election of officers, which resulted as follows: President, R. H. Blackall; first vice-president, Otto Best; second vice-president, J. E. Goodman; third vice-president, W. P. Huntley; treasurer, E. G. Desoe; secretary, F. M. Nellis; assistant secretary, F. W. Gross; Executive Committee, F. Cross, G. R. Parker and F. F. Coggin.

Chicago was selected for the next meeting place, the meeting to be held the second Tuesday in April, 1901. Thursday night a concert was given in the hotel parlors.

On Friday morning some of the convention people left for their homes; but many remained over to go on the excursion to St. Augustine. The Florida East Coast Line attached three cars to the regular morning train for the convenience of the visitors and landed them in St. Augustine about 10 o'clock, where the day was spent in visiting the old Spanish fort, the barracks, the grand hotels and the delightful views of that beautiful and quaint old city. Many went sailing and fishing. The train left at 6, and the visitors scattered for their respective homes, tired but happy. Thus ended one of the most successful of the Air-Brake conventions. Look out for the Jacksonville Proceedings.

An Injustice Done.

We learn with regret that an injustice has been done Messrs. Howell and Robinson in our last month's issue. As will be remembered, we urged correspondents to send real name and address with their communications, and spoke harshly of the use of assumed names. We had in mind a rather lengthy and technical letter which we had written Howell and Robinson in reply to a question which could not appear in that number, and which letter had been returned to us unclaimed. It now turns out that the above named gentlemen have long been readers and friends of LOCOMOTIVE ENGINEERING. They have asked numerous questions from time to time, always signing their own names. This time, however, the names were combined, the writers never thinking a correspondence would result. The letter carrier probably thought the names were those of a business firm, and knowing of no such firm returned the letter unclaimed. We cheerfully offer our apology to these men, who have been such good correspondents and who have always signed their names honestly. The combined names misled us, as they probably did the Mattoon mail carrier.

Nearly a Fatal Accident.

Otto Best has learned to regard all new-fangled devices with suspicion. The cause is this: One night during the Jacksonville convention he was standing with three companions on the corner in front of the St. James Hotel, his elbow resting on a level with his head against the lamp-post. Suddenly his arm slipped downward and struck a handle projecting from a queer-looking box on the post. A rattling and buzzing and whizzing of wheels came from within. Best seized the handle and was still endeavoring to adjust it to stop the sound, when a "hurry-wagon" and six stalwart policemen came whizzing around the corner and down on the group. Best then realized that he had accidentally touched off a patent police call and summoned to his aid his most persuasive words and mildest of tones to assure the officers that it was all an accident and mistake. Finally, the glib tongue which has done so much to bring the air-brake service on the Nashville, Chattanooga & St. Louis Railway second to none in the country, carried the day. But for a few anxious minutes it looked as though the play in the police-court matinee next morning would be "A Stranger in Florida; or, Didn't Know It Was Loaded," with Best in the title rôle.

Could Have Done Worse.

He hadn't attended the last five conventions; but the prominently displayed badge with seven bars proclaimed him a charter member of the association. "Just to think," he said, "when I began the air-brake business fifteen years ago, you could count on the fingers of your hands the men that were posted all round on the air brake. Now look at them—there are hundreds, if not thousands. Why, last night a young fellow who must have been in kilts when I was one of the wise few, asked me questions on the high-speed brake, equalization of pressure, total leverage and shoe clearance, and lots of other things I am back in. Maybe I didn't feel cheap! And maybe I didn't crawl out gracefully!" Next morning he winked as he pulled back the lapel of his coat and showed me his badge with six of the bars taken off. The remaining bar simply said: "Jacksonville."

If the ladies of the convention had been allowed even one single little vote, that vote would have been cast in a vote of thanks to Mr. Robert Burgess and his Committee on Arrangements.

The Semaphore Air Gage.

A number of complaints that the semaphore air gage does not register properly have come from several air-brake men

A GROUP IN ST. JAMES PARK.

throughout the country. Upon consideration, these complaints were found to be justified; and the manufacturers, in order to get at the true source of the trouble, made a series of tests of these gages. Four semaphore gages and four of the old-style duplex gages were placed side by side on a test rack and submitted to a sudden impulse of 70 pounds pressure, which was then exhausted from the gages. After one hundred thousand applications had been made the gages were examined and found to be without appreciable wear or deterioration.

Inasmuch that the mechanisms of the old-style duplex and new semaphore are the same—the leverage of the semaphore being higher to give the greater movement of hands—there should be no difference of operation. It has been found in

AT THE FOUNTAIN 'NEATH THE PALMS.

practice, however, that most of the incorrect gages examined show that they fail to indicate the full amount of pressure; and a careful examination of a number of such gages shows that the hands are not placed firmly enough on the post, and are jarred out of place when the rack bar or segment suddenly comes in contact with the stopping posts inside of the gage.

Practice has also shown that when more than 120 pounds main reservoir pressure is carried, the end of the segment bar passes off the pinion, thus allowing the hand to drop back a tooth and register incorrectly. The segment bar is now being lengthened to overcome this objectionable feature.

ON THE ST. JAMES HOTEL PIAZZA.

AFTER TUESDAY'S SESSION—LOCK-STEP FROM CONVENTION HALL.

A Member of the Crew of the First Air-Braked Train.

Mr. James M. Russel, now of Barnesville, Ohio, and a brakeman on the first train equipped with air brakes, the Steubenville Accommodation, writes us an interesting letter of reminiscences of that now famed train and period. The reminiscences are written in the same vein as those related by Engineer Dan Tait, each

A LARGE GROUP IN THE PARK.

one telling of prevented accidents and exciting situations. Unfortunately our columns are too crowded this month to permit the publication of Mr. Russel's letter. How unusual and delightful must be the sensations of the remaining members of this first air-brake crew when they realize that it was they who started the air brake on its powerful career! It must be like the sensations of the few surviving veterans of a great decisive battle—hard fought and hard won.

Rewarded.

Under the headlines of "Patience and Perseverance Rewarded" a country newspaper in New York State startles (?) the mechanical and railroad world as follows: "Patience and perseverance have been rewarded in the case of Guerdon S. Fanning. For fifteen years he has been working on a patent car brake, and on Thursday he received the announcement from Washington that the government had granted him letters patent on his invention. The scheme evolved by Mr. Fanning is declared by eminent railroad men to be practical, and the idea promises to revolutionize the existing methods of overcoming a train's momentum. Instead of applying the brake shoe to the rear of the car wheel, as in the present method, Mr. Fanning's method is to apply it to the front of the wheel."

ENTRANCE TO OSTRICH FARM, JACKSONVILLE, FLA.

CORRESPONDENCE.

A Good Air Pump and Metallic Packing Record.

Editor:

The engine I am now running was equipped in November, 1898, with a 9½-inch air pump, having the Phoenix metallic piston-rod packing, which has given good service, the same set being still in use in this pump, the engine having run every day since November, 1898, in heavy freight service.

The only bother I had with the packing was the nuts working loose on the stuffing-box. So in January, 1899, our foreman made a stay that fitted into notches on nuts and fastened on to the top head of the air cylinder. This held the nuts in place, and there was no more bother. I think there should be something to hold the nuts in place on the stuffing-box on all air pumps. My experience is that they are constantly working loose, causing a bad leak, which you will not notice until you stop, then you may find a hot pump and the packing burned out.

GROUP AT THE OSTRICH FARM.

One great cause of pumps running hot, as we all well know, is the use of too much oil in the air end of the pump, causing the air valves and also the discharge pipe to gum up. A few years ago I used to use engine oil in the air end of the pump, and lots of it, too. It would run all right for a while, then begin to run hot, then get very hot, and probably break an air valve or cage. I found I could avoid this to some degree by running lye through the pump and discharge pipe. It was surprising to see the dirt and oil come out of discharge pipe.

"NAPOLEON" AND HIS MATE.

A MATELESS BIRD.

Since I have had the 9½-inch pump, I have used no oil in air end of pump since January, 1899, but on the piston rod I run a good swab made of wool waste, and oil it with valve oil. When the pump had run ten months, I took the air valves out, and found very little gum on them, and they were worn but very little. The air end of the pump does not groan or get hot. The triple valves and brake valves work better now and run longer without cleaning. The leathers in brake cylinders are just as tight as they were fifteen months ago, and they haven't been renewed. I put a little valve oil in the brake cylinders every three months.

I think the Phoenix packing is all right. It is in sections and easy to put in or take out.

Thos. Hamilton.

Sioux City, Ia.

Perhaps a Leaky Graduating Valve.

Editor:

In your reply to question No. 30 in March number, I notice that you locate the difficulty in the rotary valve. You must have overlooked the statement of the

FEEDING THE OSTRICHES, JACKSONVILLE, FLA.

engineer, that the brake stays set after a 40-pound reduction, which would not be the case if the rotary was cut, as that

IN THE COURT OF THE ALCAZAR, ST. AUGUSTINE, FLA.

would raise the train line pressure and release the brake, only taking a longer time to do so.

Then he only complains of the down brake bothering him, when if it was in the rotary, all of the brakes working would release. Don't you think it more likely that the trouble was in the graduating valve of the driving brake triple? This stem may have been bent, or the seat cut, or the pin which controls the stem bent or broken. Then so long as the engineer does not reduce the train line sufficiently for the auxiliary reservoir and the brake cylinder pressures to equalize, the failure of the graduating valve to act will cause the brake to release.

The brake pistons very likely had a long travel, which made it necessary to reduce 40 pounds. Then with only 30 pounds left in the train line and a greater pressure in the brake cylinder and the auxiliary reservoir, it would be impossible for the brake to release, if the brake leather is tight.

I am of the opinion that if the engineer will have the graduating valve repaired, he will not have any more trouble with his brake. FRANK L. DILLON.

Danville Ill.

["A. D. W.," in question No. 30, does not say that the brake "stays" on, but that it "hangs" on. From this we may infer that it finally lets go. The cause could be either a leaky rotary valve or the combination of a leaky graduating valve and leaky slide valve.—Ed.]

A Valve Grinding Device.

Editor:

I have a useful tool for grinding in the supply valve of the improved reducing valve. My way is to disconnect the reducer, put a little ground glass on the seat of the supply valve, put on cap, nut and spring, screw down solid as in service and grind in from bottom. I use a piece of 1/4-inch gas pipe, 3 1/2 inches long. The end fits in the reducer 7-16 inch diameter four slots, 5-32 inch wide and 1/4 inch long. It might be of interest to say that we are using 1-inch pipe on our 8-inch pumps from pump to main reservoir.

W. H. PARKER,
A. B. Rep. Man.

San Francisco, Cal.

IN THE OLD SPANISH FORT.

Train Men's Brake Valve.

Editor:

I inclose you herewith a blueprint of a "brake application valve for train pipe" (see page 212) which was put in use some time ago on this road and proved a valuable addition to the air-brake equipment. It is placed between the hose couplings by the train men before leaving the terminals, at any suitable location in the freight train, and used by them when desirable or necessary to stop the train without depending upon the engineer. It is operated from the top of the car by a cord or wire tied near the running board, and when pulled opens the valve and allows the air to escape from the train pipe, thus applying the brakes.

The connection, without the valve, is also used between passenger cars, having one side made to couple to the train pipe coupling and the other side to the signal pipe coupling, in case of broken or obstructed train pipe, and transmits the air to the following cars through the signal pipe, and replaces the cross-over hose. The valve can be added if thought necessary. I have applied for patent on this device. J. J. SULLIVAN,
Foreman Roundhouse, L. & N. R. R.

Louisville, Ky.

A Good "Back-up" Hose.

Editor:

I send you herewith a drawing of a good "back-up" hose that was adopted by us as a standard after I had made many experiments with other and more expensive styles of cocks.

ON THE BRIDGE IN THE COURT OF THE ALCAZAR, ST. AUGUSTINE, FLA.

The valve is simply a standard 3/4-inch air stop cock with a slot, 1/4 x 7/8 inch, cut through the body and plug when the cock is in open position. The whistle is made of a piece of ¾-inch pipe, about 6 inches long, giving a very sharp, shrill whistle when cock is slightly turned. The drawing shows a cap on the whistle, but we

ON THE PEERLESS RUBBER COMPANY'S YACHT, "LADY ELLEN."

prefer to leave it off entirely and let the opening be closed by the hand when it is desired to blow the whistle. Thus the braking may be done without sounding the whistle, which is an advantage in backing into train sheds.

This tail hose is made of standard ma-

EMBARKING FOR ST. AUGUSTINE.

terial, and is so much cheaper and more durable (standing any amount of slamming around in baggage car or train box) than anything other that I have ever seen. I have taken the liberty of asking you to reproduce the drawing in your paper.

E. W. PRATT.

Chicago.

Look out for the Proceedings of the Jacksonville convention. They should be unusually interesting this year, especially to those who wish to study the successful handling of long freight trains on mountain grades.

Never was there a convention where so nearly all the members were in constant attendance, remaining from beginning to close of the sessions, or who better enjoyed the sight-seeing and pleasures of the afternoon and evening when the day's work was finished.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(48) A. B. L., Rochester, N. Y., asks:

Can you tell me what the solder is for where the wings of supply valve joins body? A.—The valve has probably developed a sand hole or proved porous, and the solder was placed there to make the valve airtight.

(49) H. H., Wymore, Neb., asks:

What kind of oil is best for use in the air cylinder of the pump? A.—A crude well oil which lubricates, cleanses and leaves no residue is best. Where a good bodied well oil cannot be had, valve or cylinder oil in spare quantities should be used. Any oil that causes heating or leaves a deposit should be instantly discontinued.

GATHERING SEA SHELLS, ANISTASIA ISLAND, ST. AUGUSTINE, FLA.

(50) L. W., Xenia, O., asks:

In using the brake valve in emergency position do we use any of the brake valve air? If not, why not? A.—By "brake valve air" we presume chamber D pressure in the equalizing reservoir and above the piston is meant. No; this air is held imprisoned in an emergency application until it leaks past the equalizing piston ring into the train pipe. The equalizing piston also remains inert during an emergency application.

(51) F. W. S., West Superior, Wis., writes:

Where can I get a book that treats on air-pump repairs? I cannot find any in your book department. A.—One of the best books on air-pump repairs is the Proceedings of the Air-Brake Association's first convention. This book is now out of print, and hard to get. We will give 75 cents and $1, respectively, for paper and leather bound copies, in good condition, of all Columbus and St. Louis Proceedings sent us.

(52) W. A. R., Glenwood, Pa., asks:

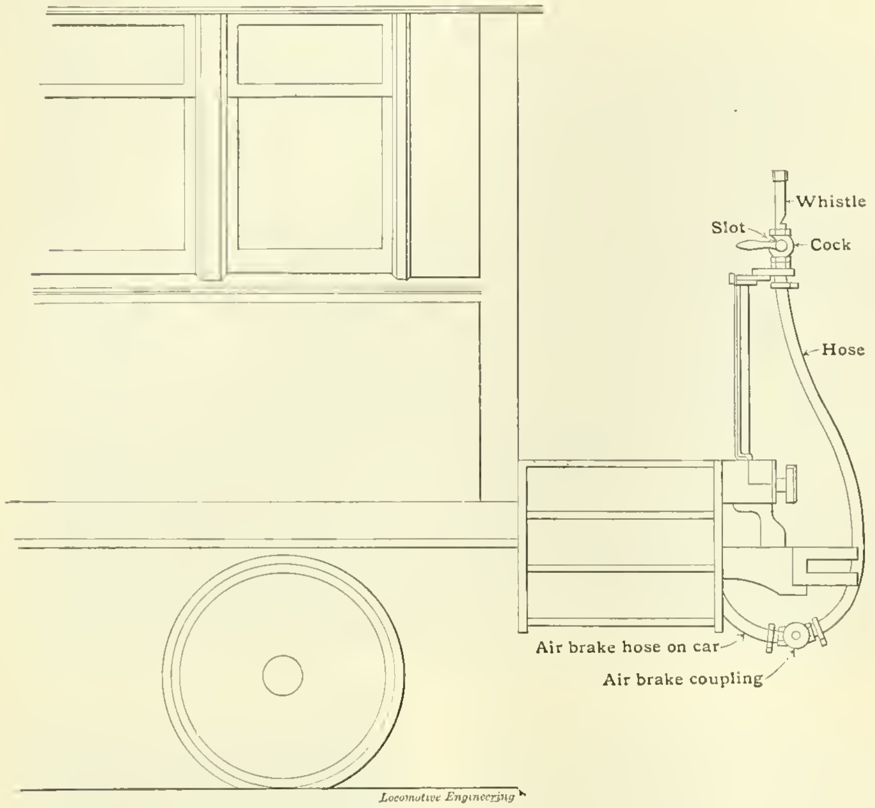
What distance should a piston travel to give the most braking power? A.—The shorter the piston travel, the greater will be the pressure on the face of the piston; but too short a travel will cause the brake shoes to rub on the wheels when the brake

ON THE BEACH.

is off. The leakage groove, which is about 3 inches long, will leak the brake off if the travel is shortened up so that the piston stands on the groove. Therefore, the best answer to your question would probably be to say about 4 inches.

(53) W. J., Rat Portage, Ont., asks:

Is the feed port of triple valves proportioned to the different sized auxiliary reservoirs? and if they are, how can we know the one from the other? A.—Yes, the feed ports of the several triple valves are proportioned to the auxiliary reservoirs



A GOOD "BACK-UP" HOSE.

so as to give an even charging up. Some of the earlier triples are not marked, but the more recent make has "F" for freight and "P" for the 10-inch passenger car brake. The large triple used on 12 and 14-inch cylinders, however, is not marked.

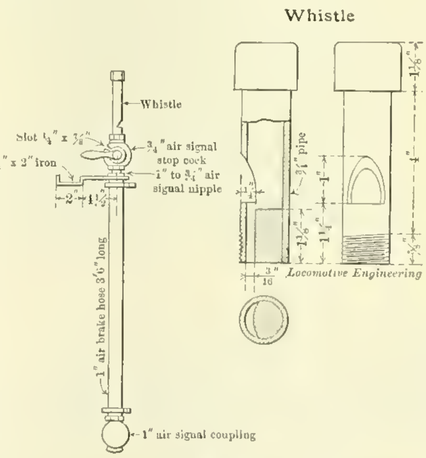
(54) C. C., Saratoga Springs, N. Y., writes:

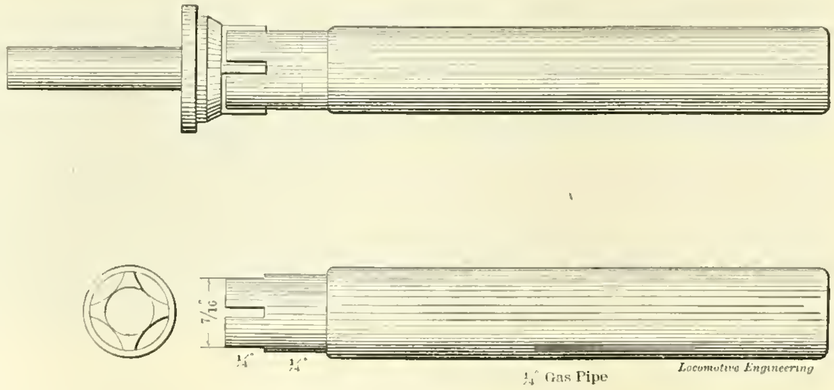
On the lower end of the equalizing piston of the engineer's brake valve is a pear-shaped projection. Please state what this is for. One man says it is to guide the stem to its seat, but I think the guide above the seat does the guiding. Please explain. A.—This projection is to more gradually taper off the train-pipe discharge, and thereby prevent a kicking off of head brakes on a long train, when the equalizing piston approaches its seat. The guiding is done by the part farther up on the stem.

(55) B. B. L., Chicago, Ill., writes:

One of our semaphore gages does not register right. It seems all right when on the testing machine in shop, but is wrong when coupled up on the engine. A.—The connecting pipes on the engine are iron, perhaps, and not carefully fitted. This will produce a twisting strain when the pipe nuts are screwed up, and will distort the inside mechanism of the gage. This is also true of the old gage, but does not show up so much on account of less sweep of hands. All gage pipes should be made of copper, for this reason. See article on semaphore gages elsewhere in this department.

(56) J. H. R., Omaha, Neb., writes:





SUPPLY VALVE GRINDING DEVICE.

To decide an argument, will you please answer the following question? If a triple is in good condition (that is, perfectly clean, with packing rings a perfect fit), will it work in service application with the graduating valve taken entirely out of the slide valve? A.—Some triple valves, if in good working condition, as you describe, will work with the graduating valve removed; but the operation is very uncertain. Sometimes service application may be had, but oftener emergency will result. Frequently, too, the valve will lap, but will leak off if allowed to stand any considerable length of time. This latter shows a leakage in the slide valve face or seat.

(57) R. W., Pine Bluff, Ark., writes:

I write you to ask some information as to the best way to face up a triple valve. Any information received I will be very thankful for. A.—The valve seat may be best brought to a true bearing by the use of a long, narrow face-plate and scraper. The slide valve face should then be placed on a face-plate and scraped down to a bearing. Then the valve and the seat should be ground together with fine ground glass, care being taken to stop grinding the instant that a good bearing surface is secured between the valve and seat. This applies to the flat-faced valve. The round-faced valve and seat may be brought to a bearing together with a round-nosed scraper and a very little grinding.

(58) J. C. H., Lima, Mont., writes:

What will cause a New York (Vaughn-McKee) brake valve to lose the entire train line pressure when placed in a service-stop notch, the equalizing piston—in fact, everything about the brake valve—appearing to be in good condition? A.—While it appears that everything is in good condition, some part, of course, must necessarily be faulty, else the trouble couldn't occur. The failure of the valve to close off the train pipe exhaust when handle is in a service notch is due to the inability of the equalizing piston to move sufficiently far forward to make the little inverted slide valve cut off the port. This is due to one or both of two causes, viz.: leakage of pressure from chamber D or equalizing reservoir, or leakage of pressure past the leather packing ot the equalizing piston into the train pipe.

(59) J. H. R., Omaha, Neb., writes:

How far does the slide valve move after the service port is closed till the exhaust port begins to open? When triple is moving from service position to release position, as near as I can measure, it is about 3-16 of an inch, but I am not sure. What I am figuring on is the distance that the piston and slide valve will have to jump to open the exhaust port in case of a sticky or dirty triple working in service with the graduating valve taken out. I think that it will work all right in service if the triple is in good condition, but if gummy or sticky I am not sure whether it will jump to release or not. A.—The bridge between the lap position of the triple valve and the opening of the exhaust port, or beginning of the exhaust, is about 3-32 inch wide in the freight triple, and possibly a little more in the passenger triple. This distance is easily jumped by a slide valve which does not move uniformly but goes in jerks. Even a freshly cleaned valve will jerk and jump it.

(60) C. V., Philadelphia, Pa., writes:

Please answer this question. It will settle an argument question with an eleven-car train. An engineer was stopped very short by a stud in his main reservoir blowing out. I am aware of the fact that the brakes went on entire train, and on hard, too; but the man that this happened to claims the four brakes on head end of train did not apply; still, he had no air in his train pipe after the stop. Please answer what the trouble is that these brakes were not on, or what could have released them, providing they did go on. A.—The brakes undoubtedly applied to the whole eleven cars and then leaked off of the first four, thus giving the impression that the first four brakes did not apply. Inasmuch as there was no air in the train pipe, the application of the brakes cannot be disputed, providing they were cut in. Their release, however, was probably had through a leaky leather packing in the brake cylinder or past a leaky emergency check valve. In either case, the brake cylinder pressure would escape and release the brake in a period of time varying with the degree of leakage past the leather or emergency check valve.

(61) F. R. F., Rawlins, Wyo., writes:

1. Is there any other make of brake valve like the New York, as the Union Pacific 1700 class has one which I took to be a New York, but the air man here says is some other make? A.—1. The brake valve most recently supplied by the New York Air-Brake Company is the Vaughn-McKee valve, which is cylindrical and lies horizontal. The New York valve proper is also cylindrical form, but stands vertical. The handles of both work in a vertical plane, like the reverse lever of the engine. The Westinghouse works in a horizontal plane. 2. Two new engines passed through here to-day for the Southern Pacific. I notice that the main reservoir pipe from the pump is tapped into the right steam chest. Will you please tell me, through your paper, if this is to pump air into the reservoir while engine is drifting, and if so, why it is not used on both sides? A.—2. Yes, this device is to pump air while the engine is drifting down a grade, to assist the pump. It is known as the Sweeny air compressor, and was invented by an engineer on the Southern Pacific, where it is extensively used. As the steam chests are connected by the steam pipes, the output of both cylinders can pass through the single pipe from the steam chest to the main reservoir.

One of the most interesting exhibits at the convention was the ingenious and unique instruction chart designed and patented by Messrs. Ettinger and Lofy, of the Wabash road, and illustrated in our March number. This little device is a great aid in instruction work, and should be in every instruction room and car. It is worth more than a whole set of sectional apparatus.

A special vote of thanks of the convention was tendered the officials of the Plant System and the Florida East Coast Line for an unusually liberal distribution of free passes to the convention people, who were thus privileged to visit Tampa, Palm Beach and other points on these systems.

We will pay 75 cents and $1, respectively, for all paper and leather bound copies of the Proceedings of the Columbus and St. Louis conventions sent us in good condition.

James Ritchie, of Brooklyn, N. Y., has been granted a patent for a device intended to prevent the rattling noise of the brake shoe, incident to the setting of the air brake.

A Broken Piston Valve.

In this item we do not wish to call attention to the mishaps of engineers, but set them to thinking about what to do in case the forward steam chest head is broken off of a piston valve engine of the Brooks type. With any type of piston valve engine, where the live steam is between the heads of the valve or inside the "spool," as some term it, there is no need of worrying about getting help or giving up the train. Exhaust steam only is what comes out at the leak. The engine possibly will not steam as well with the exhaust steam escaping to the atmosphere there as if it went out through the proper channel, up the stack; but she will be just as powerful as ever with the steam she has.

On one of the engines equipped with a Brooks piston valve, drawing an important train on a trunk line, the bolts holding the eccentric blade to the strap worked loose. This allowed the piston valve to travel too far forward, striking the head of the steam chest, and as this is a pretty heavy valve, it soon pounded the head off. The engineer stopped the train, put a bolt in the strap and blade, got help and was towed in. On arrival at the terminal it was soon proved to him by operating the engine in the yard, that only exhaust steam could escape from the opening in the steam chest where the head should be. This steam had done its work in drawing the train, and the engine should have brought the train in without help, if she would steam in this condition.

When new types of machinery are introduced, the first man who has a breakdown usually furnishes an object lesson to all the others—sometimes at his expense. No doubt this man is much more competent on account of this object lesson, and the company should take this view of the case.

By Pass Valves.

Mr. W. H. Lewis, superintendent of motive power of the Norfolk & Western Railroad, has used by-pass valves for the cylinders of his large compound engines, but he has abandoned their use. Writing on the subject, he says:

"With reference to the performance of the engine with and without the by-pass valve, I beg to explain that the by-pass valves with which this engine was fitted had an area of opening connected with the steam port with the ends of cylinders of 1.96 square inches, the volume of the cylinder being 6 cubic feet. The indicator diagrams show that there was no perceptible difference in the vacuum lines when running at a speed of 30 to 37 miles per hour, the compression lines being only slightly in favor of the by-pass valve, but not sufficient to justify the additional expense and cost of maintenance of same, and we therefore decided to abandon them, and while it might be desirable for engines running at high speeds, we do not believe that this feature possesses any particular merit for slow-speed engines."

A Drop Pit for Coach Wheels.

At El Paso, Texas, it is not unusual to have to change wheels under the Pullman sleepers that go across the line into Mexico. If the wheels do not look as if they would run all right till they get back to Texas again, they are taken out there to save paying duty on the other wheels sent over.

Changing wheels on a passenger car en route, with the passengers and train waiting is a "hurry up" job. To get out the inside pair of wheels in a six-wheel truck means to jack that end of the coach up very high. General Foreman Booth of the Santa Fe at El Paso has got this business down fine, and holds the record for a quick job, but he will have it down still finer when the new drop pit is finished for taking out and replacing these wheels.

By the way, why won't it pay to have a drop pit in every coach yard to expedite the work of taking out wheels?

AIR-BRAKE ASSOCIATION AT HOTEL ST. JAMES, JACKSONVILLE, FLA., APRIL 4, 1900.

Personal Department.

Mr. J. K. Ritz has been appointed superintendent of the Georgetown & Western at Georgetown, S. C.

Mr. Alex. Laird has been appointed master mechanic of the Ohio & Little Kanawha at Fair Oaks, Ohio.

Mr. J. H. Stokes, general foreman of the Plant sysytem, has been transferred to Montgomery, Ala., from Thomasville.

Mr. W. S. Groves has been appointed trainmaster of the Lebanon division of the Philadelphia & Reading at Reading, Pa.

Mr. Joseph Clare has been appointed foreman of locomotive repairs of the Cincinnati, Hamilton & Dayton at Cincinnati, Ohio.

Mr. F. T. Robertson has been appointed superintendent of the Montana Railroad at Lombard, Mont., vice Mr. G. F. Wentworth.

Mr. N. Kirby has been appointed master mechanic of the Mobile & Ohio at Tuscaloosa, Ala., vice Mr. J. J. Thomas, Jr., promoted.

Mr. T. F. Barton has been appointed to succeed Mr. M. S. Curley as master mechanic of the Illinois Central shops at Paducah, Ky.

Mr. J. C. Barry has been appointed road foreman of engines on the Ohio River Railroad, with headquarters at Parkersburg, W. Va.

Mr. D. B. Hines has been appointed foreman of the Union Pacific shops at Columbus, Neb., succeeding Mr. J. Naismith, promoted.

Mr. W. Piffen has been appointed traveling engineer, with jurisdiction over the Montgomery and Mobile divisions of the Mobile & Ohio.

Mr. M. S. Curley has been appointed master mechanic of the Memphis shop of the Illinois Central, in place of Mr. W. White, resigned.

Mr. James H. O'Neil has been appointed trainmaster of the Montana Central at Great Falls, Mont., succeeding Mr. A. E. Long, transferred.

Mr. A. A. Driggs has been appointed superintendent of the Pecos River Railroad at Pecos, Texas, succeeding Mr. J. E. Bowen, resigned.

Mr. William Miller has been appointed master car builder of the Erie & Wyoming Valley at Dunmore, Pa., vice Mr. Sidney D. King, resigned.

Mr. J. H. Tinker has been appointed master mechanic of the Pennsylvania at South Amboy, N. J., succeeding Mr. Thomas Kerr, retired.

Mr. J. O. Boyle has been appointed trainmaster of the Western division of the Chicago, Rock Island & Pacific at Topeka, Kan., succeeding Mr. W. R. Morton, resigned.

Mr. R. W. Wheeler has been appointed trainmaster of the Southern Missouri & Arkansas at Cape Girardeau, Mo., succeeding Mr. A. S. Webb.

Mr. J. Naismith, foreman of the Union Pacific shops at Columbus, Neb., has been promoted to the position of master mechanic at Cheyenne, Wyo.

Mr. A. Link has been appointed general foreman of the Michigan division of the Cincinnati Northern at Van Wert, O., vice Mr. W. A. Stone, resigned.

Mr. A. G. Machesney, master mechanic of the Cornwall Railroad, has resigned to accept a position with the Baldwin Locomotive Works as traveling agent.

Mr. W. White, master mechanic of the Illinois Central at Memphis, Tenn., has resigned, to accept a similar position with the Lake Erie & Western, at Lima, Ohio.

Mr. W. J. McGee, formerly machinist at Waycross, Ga., on the Plant system, has been promoted to be general foreman at Thomasville, Ga., on the same system.

Mr. Hugh G. Bowles has been appointed superintendent of the Monongahela River divi ion and Fairmont terminal of the Baltimore & Ohio, with office at Fairmont, W. Va.

Mr. G. M. Tower has been appointed general foreman of the Sayre shops of the Lehigh Valley Railroad. Mr. Tower was formerly a shop foreman on the Fitchburg Railroad.

Mr. E. Gillette has been appointed assistant superintendent of the Wyoming division of the Burlington & Missouri River at Sheridan, Wyo., suceeding Mr. H. C. Nutt.

Mr. J. G. Neudorfer has been appointed to succeed Mr. T. F. Barton as master mechanic of the Mississippi and Alabama division of the Illinois Central at Water Valley, Miss.

Mr. Wm. L. Stevenson, superintendent of the Fitchburg at Boston, has resigned to accept the position of general manager of the Sioux City Terminal Railway at Sioux City, Ia.

Mr. F. M. Jones has been appointed trainmaster of the Iowa and Northwestern divisions of the Chicago, Rock Island & Pacific at Davenport, Iowa, vice Mr. T. C. Scott, deceased.

Mr. W. B. Gaskins has been appointed superintendent of motive power and machinery of the Pecos Valley & Northeastern at Roswell, N. M., succeeding Mr. C. M. Stanbury, resigned.

Mr. Charles G. Langston has been appointed assistant master mechanic in addition to his previous duties as general foreman of the St. Louis Southwestern shops at Pine Bluff, Ark.

Mr. R. H. Soule, who has been for several years agent for the Baldwin Locomotive Works in Chicago, has resigned, and will open an office in New York as consulting mechanical engineer.

Mr. W. T. Bradford has been promoted from the position of chief engineer of the Pine Bluff & Western to superintendent, with office at Pine Bluff, Ark., succeeding Mr. T. F. Doyle, resigned.

Mr. J. H. Reynolds has been appointed trainmaster of the Jamestown & Franklin division of the Lake Shore & Michigan Southern, vice Mr. S. R. Payne, resigned; headquarters at Ashtabula, O.

Mr. F. G. Stout, general superintendent of the Wheeling & Lake Erie, has resigned to accept the position of general manager of the Toledo, Fremont & Norwalk, the proposed electric road in Ohio.

Mr. Wm. H. Hill, formerly with the Union Pacific at Denver, Colo., has been appointed master mechanic of the Cornwall Railroad at Lebanon, Pa., succeeding Mr. A. G. Machesney, resigned.

Mr. James H. Hustis has been appointed superintendent of the Harlem division of the New York Central & Hudson River, vice Mr. James H. Phyfe, resigned; headquarters at White Plains, N. Y.

Mr. S. W. Miller, general foreman of the Pittsburg, Cincinnati, Chicago & St. Louis shops at Dennison, Ohio, has been promoted to the position of assistant master mechanic at Indianapolis, Ind.

Mr. C. R. Ord, air brake inspector on the Canadian Pacific, has been selected to succeed Mr. W. Cross as general master mechanic of the Western division of the Canadian Pacific at Winnipeg, Man.

Mr. W. T. Smith, assistant master mechanic of the Chesapeake & Ohio at Covington, Ky., has been promoted to the position of master mechanic at Richmond, Va., vice Mr. T. S. Lloyd, resigned.

Mr. Henry Mason, formerly roadmaster of the Illinois Central at Pinckneyville, Ill., has been appointed superintendent of the Wabash, Chester & Western, with headquarters at Chester, Ill.

Mr. J. E. Gould has resigned as general foreman of the Toledo & Ohio Central shops at Columbus, O., to become master mechanic of the Cincinnati, New Orleans & Texas Pacific at Chattanooga, Tenn.

Mr. Samuel B. Hynes has been elected secretary of the Safety Car Heating & Lighting Company, with office at Chicago, Ill., vice Mr. C. H. Howard, resigned to accept a position with another company.

Mr. Frank H. Marsh, superintendent of the Chicago & Milwaukee division of the Wisconsin Central, has been promoted to the position of assistant general superintendent, with office at Milwaukee, Wis.

Mr. W. Cross has been promoted from the position of general master mechanic of the Western division of the Canadian Pacific at Winnipeg, Man., to consulting mechanical engineer of the same division.

Mr. Grant Pryor has been appointed general foreman of the Buffalo & Susquehanna shops at Galeton, Pa., to succeed Mr. F. H. Streiber, who has resigned to accept a more lucrative position at Oil City, Pa.

Mr. Jacob B. Bronson, a prominent engineer of the Erie & Wyoming Valley, has been appointed road foreman of engines. Owing to Mr. Bronson's popularity, this appointment finds great favor with the railroad men.

Mr. J. J. Meckedon, for a number of years foreman of the St. Louis Southwestern at Jonesboro, Ark., has been appointed master mechanic of the Little Rock, Hot Springs & Western at Hot Springs, Ark.

Mr. Garrett O'Neill has been appointed superintendent of the Pacific & Idaho Northern at Weiser, Idaho. He was formerly assistant superintendent of the Wyoming division of the Union Pacific at Evanston, Wyo.

Mr. C. H. Welch, general foreman of the Lehigh Valley shops at Sayre, Pa., has been appointed division master mechanic of the Choctaw, Oklahoma & Gulf at North Little Rock, Ark., vice Mr. Charles Robken, resigned.

Mr. C. M. Marshall, road foreman of engines for the Peoria, Decatur & Evansville at Mattoon, Ill., has resigned to accept the position of general foreman of locomotive repairs of the Missouri Pacific at Atchison, Kan.

Mr. R. H. Brown, general superintendent of the St. Louis Southwestern of Texas, has been appointed vice-president in addition to his other duties, succeeding Mr. F. H. Britton, elected president; office at Tyler, Texas.

Mr. Wm. T. Reed, superintendent of machinery of the Seaboard Air Line at Portsmouth, Va., has been appointed one of the judges for the Paris Exposition. He has also been given the title of mechanical superintendent.

Mr. R. Atkinson, mechanical superintendent of the Canadian Pacific at Montreal, has been advanced to the position of superintendent of rolling stock. This change will put Mr. Atkinson in charge of cars as well as locomotives.

Mr. J. F. Deems has been promoted from the position of master mechanic of the Iowa division of the Chicago, Burlington & Quincy at West Burlington, Ia., to assistant superintendent of motive power; headquarters at West Burlington, Ia.

Mr. Raymond Du Puy, for the last year superintendent of the Delaware, Lackawanna & Western at Hoboken, N. J., has resigned. Mr. Du Puy has been very popular with the employés of the road, and regret is expressed that he is leaving.

Mr. A. H. Thomas, assistant to the superintendent of motive power of the Pittsburgh, Cincinnati, Chicago & St. Louis, at Columbus, O., has been appointed general foreman of the shops at Dennison, O., vice Mr. S. W. Miller, promoted.

Mr. C. H. Ketchum, for some months terminal agent of the "Lackawanna" at Hoboken, has been appointed superintendent of the same road, taking the place of Mr. Du Puy, resigned, with headquarters at Hoboken, N. J. Mr. Ketchum was for some years general superintendent of the West Shore Railroad.

Mr. David Brown, who resigned a few months ago as master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa., has been reappointed to his old position. Mr. Brown is one of the best shop managers in the country, and we are glad to see him return to the shop, where his work will be appreciated.

Mr. C. T. Schoen, the inventor of the pressed-steel car and the proprietor of the largest car-manufacturing plant in the world, will deliver a lecture in July before the technical men who will be assembled at the Paris Exposition. The pressed-steel cars made especially for the show will be placed in a conspicuous place where they can be seen by the multitudes, and Mr. Schoen's lecture will be on the subject of the development of the modern steam railway car.

Mr. J. O. Pattee, recently superintendent of motive power of the Great Northern Railway, has been appointed superintendent of motive power of the Missouri Pacific (headquarters, St. Louis, Mo.), succeeding Mr. Frank Rearden, resigned. A couple of days previous to his leaving for St. Louis, a few of his numerous friends met at his residence at St. Paul and presented him with a loving cup and purse. It is needless to say that the gifts were highly appreciated, as well as the many kind words spoken by his friends. Mr. Pattee was highly thought of by all classes of men in his department, and he has the best wishes of the Great Northern system, for success in his new field.

The following appointments have been announced on the Chicago & Northwestern: W. D. Cantillon, superintendent of the Dakota division, in addition to the superintendency of the Winona & St. Peter division (headquarters at Winona, Minn.); F. N. Stewart, assistant superintendent of the Dakota division, with headquarters at Huron, vice H. R. Sanborn, promoted; H. R. Sanborn, acting superintendent of the Western Iowa division, vice S. M. Braden, transferred (headquarters at Lake City, Ia.); William Hengster, trainmaster Winona & St. Peter and the Dakota divisions, with headquarters at Tracy, Minn.; S. M. Braden, superintendent of the Iowa & Minnesota division, extending from Fox Lake, Minn., to Muchaknock, Ia. (headquarters at Belle Plaine, Ia.).

Mr. W. H. V. Rosing, one of the ablest mechanical engineers in railroad service, has obtained well-earned promotion to the position of assistant superintendent of motive power of the Illinois Central, a company which he has served during the greater part of his working life. Mr. Rosing received part of his education abroad, but he graduated from the Massachusetts Institute of Technology in 1880, and then went to work as a machinist helper in the Illinois Central shops at Chicago. After two years' work in the shop he was transferred to the drawing office, and gradually worked up to the top of that establishment. He went with Mr. Schlacks to the Denver & Rio Grande, but remained there for only a few years, and he was for a time with the Grant Locomotive Works, but he has been back with the Illinois Central for several years.

On the front outside cover of *Success* for April thousands of railroad men and others will recognize the genial countenance of H. H. Vreeland, president of the Metropolitan Street Railway Company of New York and president of the New York Railroad Club. Inside of the paper is an interesting story of Mr. Vreeland's life, telling how he rose from a very lowly position in railroad life to the top of the ladder. *Success* is a monthly magazine published in New York, devoted to making interesting reading about people and things that have proved successful in the world. They selected a particularly happy subject in Mr. Vreeland. To those who are toiling at the base of the railroad ladder, enduring the heat of the day and the fatigue of the night watches, we would say, read the brief sketch of Vreeland's life and it will teach a lesson of perseverance in well doing that will bring gratifying reward before many days. The tone of *Success* is of a character to stimulate everyone with laudable ambition to "labor and wait."

The following changes are announced in the operating department of the Illinois Central: Mr. A. H. Egan, until recently assistant superintendent at Evansville, Ind., has been appointed assistant superintendent of the Chicago division, with headquarters at Chicago, in direct charge of the transportation service of the Chicago terminals. Mr. H. McCourt, superintendent of the St. Louis division, is appointed superintendent of the Chicago division, with headquarters at Chicago, in place of Mr. H. Baker, who is made superintendent of the Amboy division, with headquarters at Clinton, Ill. The latter succeeds Mr. J. C. Dailey, who goes to Carbondale, Ill., as superintendent of the

St. Louis division, in place of Mr. McCourt. Mr. H. R. Dill, superintendent of the Freeport division, is appointed assistant superintendent at Evansville, Ind., in place of Mr. Egan, and Mr. H. U. Wallace, assistant superintendent of the Evansville district, Louisville division, is appointed superintendent of the Freeport division, with headquarters at Freeport, Ill., in place of Mr. Dill.

The Oldest Engineer on this Continent.

Mr. Christian Smith, the subject of our illustration, is the oldest living locomotive engineer on this continent. Mr. Smith was born at Middleburg, Md., on the 14th of April, 1812, and is consequently in his eighty-eighth year. Mr. Smith followed farming until twenty years of age, when he entered the service of the Baltimore & Ohio Railroad as teamster. He remained in that position about six months and was then promoted to the position of brakeman, and continued as such until April, 1836, then went to firing an engine on the Washington branch of the Baltimore & Ohio Railroad. On June 1 of the same year he was sent to Plane No. 4 on main stem to run engine "John Quincy Adams" between Plane No. 4 and Point of Rocks, continuing in said capacity until 1840, when he was made conductor of the first mail train that was run between Baltimore and Frederick. In 1842, the road being completed to Cumberland, he again took an engine, running about six years, when he went with the Little Miami Railroad, in Ohio. He returned to the Baltimore & Ohio in 1851, and left again in 1852, going with Smith & Perkins, locomotive builders, Alexandria, Va., for whom he delivered many engines to the different roads throughout the country. He, however, returned to his first love the same year, ran an engine about two years, when he was appointed supervisor of engines, serving in that capacity until 1858, when he again returned to the throttle for two years, and was then made agent at Martinsburg, and continued as such until the breaking out of the war, when he was transferred to Relay Station as agent and postmaster, and from there to Harpers' Ferry, where he remained until the close of the war, when he was appointed supervisor of engines. He acted in that capacity until 1873, when he retired to his farm on Maryland Heights, near Harpers' Ferry, where he still resides, hale, hearty and active.

MR. CHRISTIAN SMITH.

One Way of Booming New England.

In its mission of promoting and bringing New England into prominence as a vacation and tourist resort, the Boston & Maine Railroad endeavors to place before the public descriptive matter that is interesting, instructive and authentic.

Last year three portfolios were added to the list of illustrated publications, which bear the following titles: "New England Lakes," "New England Rivers" and "Mountains of New England." These portfolios are half-tone reproductions, 4 x 6 inches in size. For the present season two additional portfolios have been prepared, namely, "Sea Shore of New England" and "Picturesque New England" (historical-miscellaneous).

In the Sea Shore portfolio, among the thirty odd views of the rugged New England shore is a distant outline of Grover's Cliff, at Beachmont. In the vicinity of Marblehead are pictures of the surf and of the ancient wharves and of scenes in the harbor; then there is a picture of the "Singing Beach" at Manchester on the North Shore. Gloucester affords a variety of scenic display which depicts harbor and shore scenes. Further down the shore are vistas of picturesque surroundings at Ipswich Bluff, in the vicinity of Newburyport and at Salisbury. Of Hampton Beach and the Isles of Shoals there are several views, as well as York Beach. Likewise of Kennebunk and Old Orchard there are several delightfully pleasing representations of familiar places.

The Picturesque New England portfolio is indeed one of the most interesting of the series, as it treats of a variety of subjects with which all are acquainted. Pictures are shown of the birth-places of Whittier, Hawthorne, Rebecca Nourse, Horace Greeley and President Pierce, while the revolutionary reminders include illustrations of the Munroe Tavern; the Monument and Minute Man Statue at Concord, Mass.; the Governor Craddock House, at Medford, and General Gage's Headquarters. The Colonial period is suggested in a collection embracing illustrations of the Frary House, the Governor Wentworth Mansion and the Hannah Duston Monument. The rural districts are attractively displayed in numerous views of inland scenes in the vicinity of Hadley, Lancaster and Groton, Mass., and Charlestown, N. H.

Either one or all of these five portfolios can be obtained by sending six cents in stamps for each book to the General Passenger Department, Boston & Maine Railroad, Boston, Mass.

Hinged Pilot Drawbar.

Mr. W. J. McLean, master mechanic of the Bellingham Bay & British Columbia Railroad Company at New Whatcom, Wash., sends us a photograph of the folding pilot drawhead shown in cut.

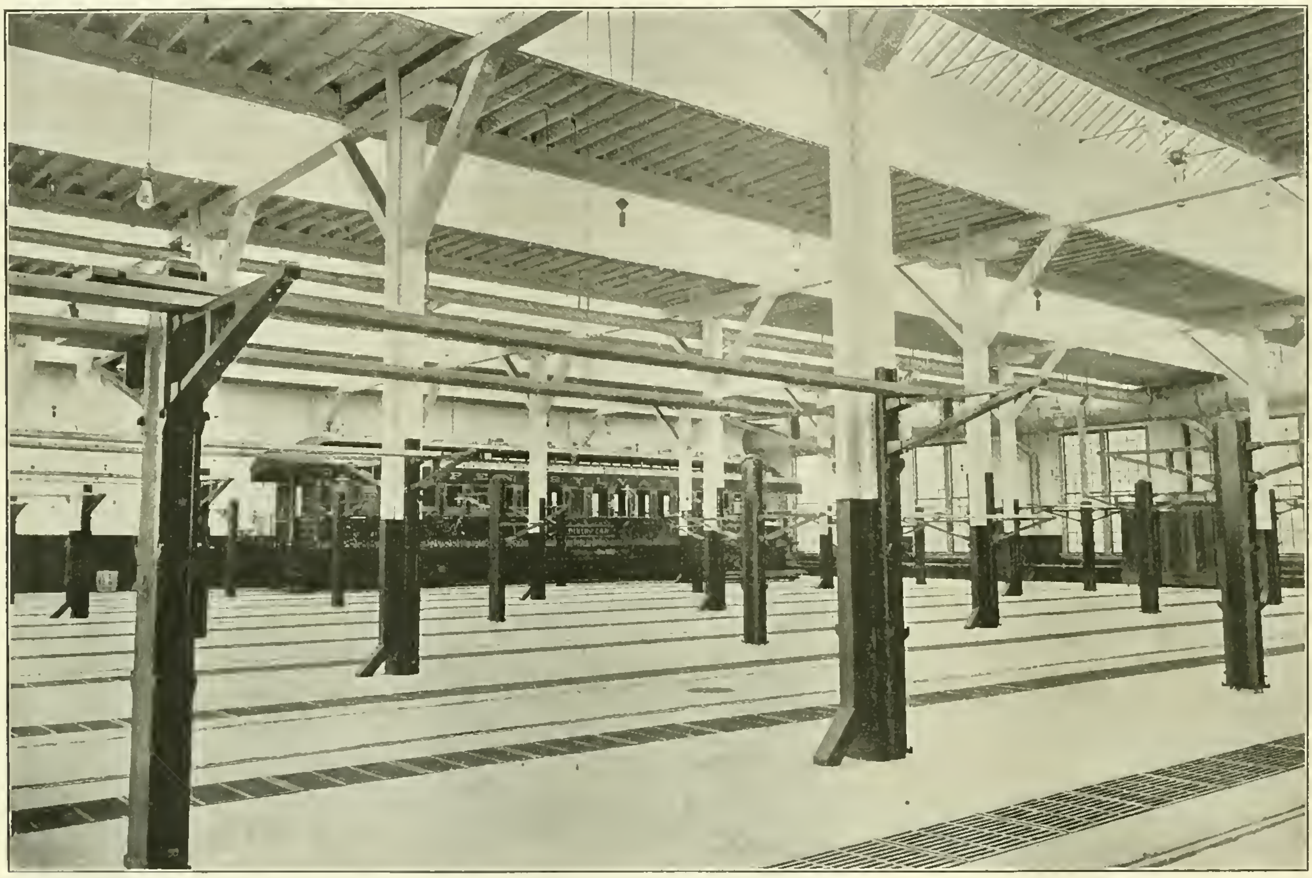
It is cast iron, and the pocket is of standard size to receive the shank of an M. C. B. coupler. This enables them to replace it at any time by a standard coupler if desired. It has been used very successfully for some time on this road, and is shown by Mr. McLean for the benefit of others.

W. J. M'LEAN'S FOLDING DRAWBAR.

A Passenger Car Paint Shop.

The accompanying engravings show, both by photograph and diagram, the arrangement of the passenger car paint shops of the P. C. C. & St. L. These speak for themselves so plainly that little description is necessary. It is one of the many installations of the B. F. Sturtevant Company, of Boston, and it is interesting to note the main dimensions of the heating apparatus.

The fan wheel is 7 feet in diameter by 4 feet wide, and is driven by a 7 x 10½-inch horizontal engine, which runs the fan about 255 revolutions per minute. The air is drawn through a heater containing 6,500 lineal feet of 1-inch pipe, and is delivered at the outlet at a velocity of about 3,500 feet per minute. It passes down from the fan to discharge pipe and is conveyed all over the shop and down to floor as shown by illustration.



P. C. C. & ST. L. PASSENGER CAR PAINT SHOP.

To assist in meeting the great demand for their positive driving drill chuck, the Pratt Chuck Company, of Frankfort, N. Y., have found it necessary to install a new 150 horse-power Corliss engine. Their success in their sales department has been almost phenomenal, having, in addition to the large number of orders ahead, daily additions. They attribute the secret of their success to the fact of their chuck permitting the drill to be worn out without slipping or defacing the drill numbers, thus saving much time to the machinist.

Smoke Prevention.

At the April meeting of the Western Railway Club the committee appointed at the October meeting to take up the matter of smoke prevention by the various railroads entering Chicago, made their report. It is too long to publish in full, the following extracts will show how the committee look at this matter, and we are sure that their views are entitled to respect:

"There seems to be quite a diversity of opinion among the different motive-power officers as to the value and merit of the various devices advocated for the purpose of preventing smoke. Some arrangements are endorsed heartily by certain parties and are pronounced worthless by others, while it is positively known that possibly the best example of smokeless firing is given by a road that uses no device but the brick arch.

"This being the case, your committee finds it difficult to make any definite recommendations as to the feasibility of mechanical contrivances, some of them being so preposterous and *un-mechanical* that they could hardly be seriously considered.

"In order to get a complete list of the different methods adopted by the various roads entering this city, the following questions were asked of the motive-power departments:

"First—What devices or appliances are you using to prevent smoke on your passenger, freight and shifting engines running into Chicago? Please give us full particulars, with blueprints illustrating said appliances, also statement of kind of fuel used and any other data.

"Second—What results are obtained with such devices as you may have in use, and what tests have you made with such appliances, and with what success has this been attended? If not successful, can you say why?

"Third—What policy do you adopt when building new locomotives that will run into Chicago, in order to better prevent the smoke nuisance in the way of special devices applied to engines, or particular size or arrangement of firebox or flues?

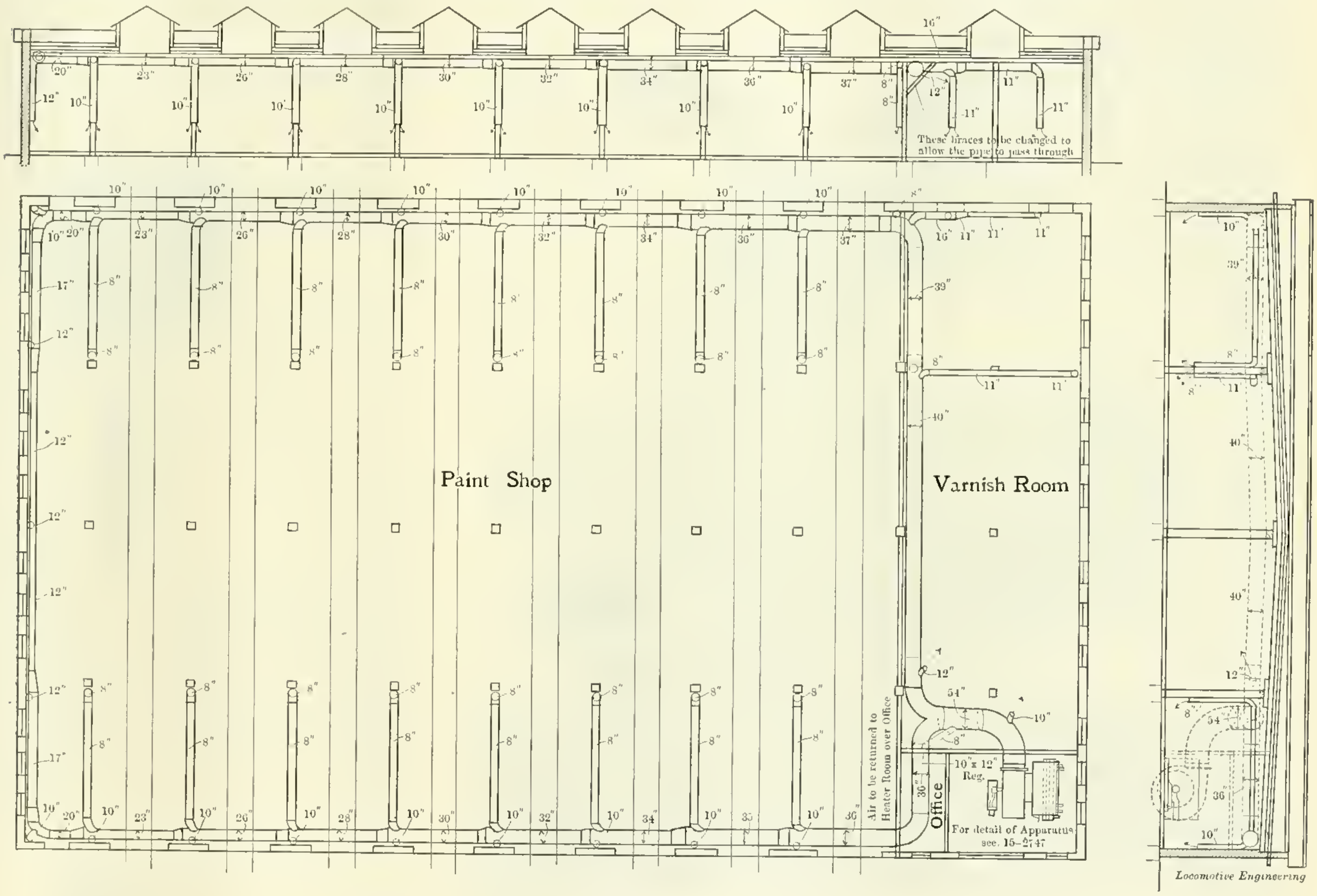
"Fourth—Please furnish a list of coals which you are using in this locality, with analyses and relative steaming and smoking values.

"We do not expect that these points can be answered absolutely and accurately. We think that an abstract giving your views on the same will be of value.

"Fifth—How do you look upon the efficiency of various firemen in connection with the smoke-prevention subject, and what instructions or orders have you issued to your men in regard to this subject?

"Many of the replies to this circular were very full and complete, with drawings. With the exception of the brick arch, which is quite generally used, the air injector (or jet of air forced into the firebox through openings through the water space) seems to be the favorite method of smoke reduction, though some claim that it is more of a smoke *diluter* than a smoke *consumer*. Most roads using these air jets report successful results when they are properly manipulated, and particularly when used in connection with a brick arch. They are not claimed, however, to produce economical results, partly due, no doubt, to the fact that the air is more or less cold when it enters the firebox. There are some suggestions for heating the air before it is forced into the firebox, but most of the methods suggested seem to your committee to be impracticable.

"The importance of careful firing is recognized by all the roads reporting to your committee, the general sentiment cerned. The engineer should be quick to appreciate the effects of his manipulations on the fire and regulate the "cut-off" and throttle, as far as possible to produce the best results, keeping his fireman informed of his intended movements. The fireman should be on the alert to take every advantage of the physical conditions of the road or any cessation in the work, and should fire lightly and regularly—not five or six shovelfuls with a rest in between, but with one shovelful at a time and the door closed gradually—that is, cracked for a few seconds, until there is sufficient air to consume the fresh distillates, and then closed completely, except where a damper or register in the door is employed. The a convenient height and of a suitable size, the steam gage should be in *comfortable* view, both by day and night, the blower or smoke consumer valves should be quick acting and convenient of access from the foot plate, and water gages should be arranged for constant observation. Sloping sides to the tank, and coal properly broken up, will also facilitate the work so that the man with the shovel can give his complete attention to firing and other necessary duties. Many engines are so inconveniently arranged in the cab that it is almost preposterous to expect and ask good results, and a ride on the engine will often show the unintelligent manner in which the fittings have been placed."



HEATING AND DRYING CAR PAINT SHOP (DESCRIPTION ON PAGE 218).

obtaining that a good fireman without a special device is productive of better results than any of these devices poorly managed.

"Nearly all of the roads have not only issued concise instructions to their engineers and firemen from time to time, but it is a common practice to select expert firemen and employ them to travel on the engines and explain and illustrate the proper methods of firing to those who are less expert in the matter. Nor can all be done by the fireman—the engineer must also assist, both by handling the engine in an intelligent manner and by communicating constantly with the fireman. In fact, to produce the best results, there must be a hearty co-operation between those con- gage should be scrutinized every few minutes, and the supply of air regulated principally by the dampers; the blower and smoke consumer must be ready for instant use on the closing of the throttle, as this is the time that the greatest volume of smoke is likely to be produced.

"In order to effect these results, however, the motive power officials must perform their part. In European countries it is considered dangerous to make a man on an engine too comfortable, as such an arrangement may make him careless in his work; the theory obtaining on this side of the Atlantic, however, is that the more comfortably a man is installed the better can and will he attend to his duties. With this end in view, fire doors should be at

Copious extracts from the replies were included in the report, but the above from the committee gives a consensus of the opinions.

In the discussion which followed the reading of the report by Mr. G. R. Henderson the chairman, Dr. Reynolds of the health department and Mr. Schubert, the smoke inspector, both thanked the committee and the railroad officers for their work, saying that the smoke nuisance had been abated considerably.

Mr. Schubert spoke of a device used on a Fitchburg Railroad engine, which gave excellent results, invented by Mr. Hughes. Grinding the coal up into a fine powder and blowing it into the firebox with a stream of compressed air was also spoken of; two devices, one by Mr. Westlake, of the firm of Adams & Westlake, and another by a German inventor, being in use, that were very satisfactory. Several members mentioned the fact that a device that would give good results on a stationary plant, where the draft was steady and of the same force all day long, might be useless on a locomotive, where the conditions were constantly changing. With a stationary plant, devices could be put in the brick walls of the furnace, and the grate surface could be ample, while with a locomotive firebox the grate surface was usually so restricted that an excessive amount of coal per square foot of grate surface must be consumed per hour, which meant imperfect combustion.

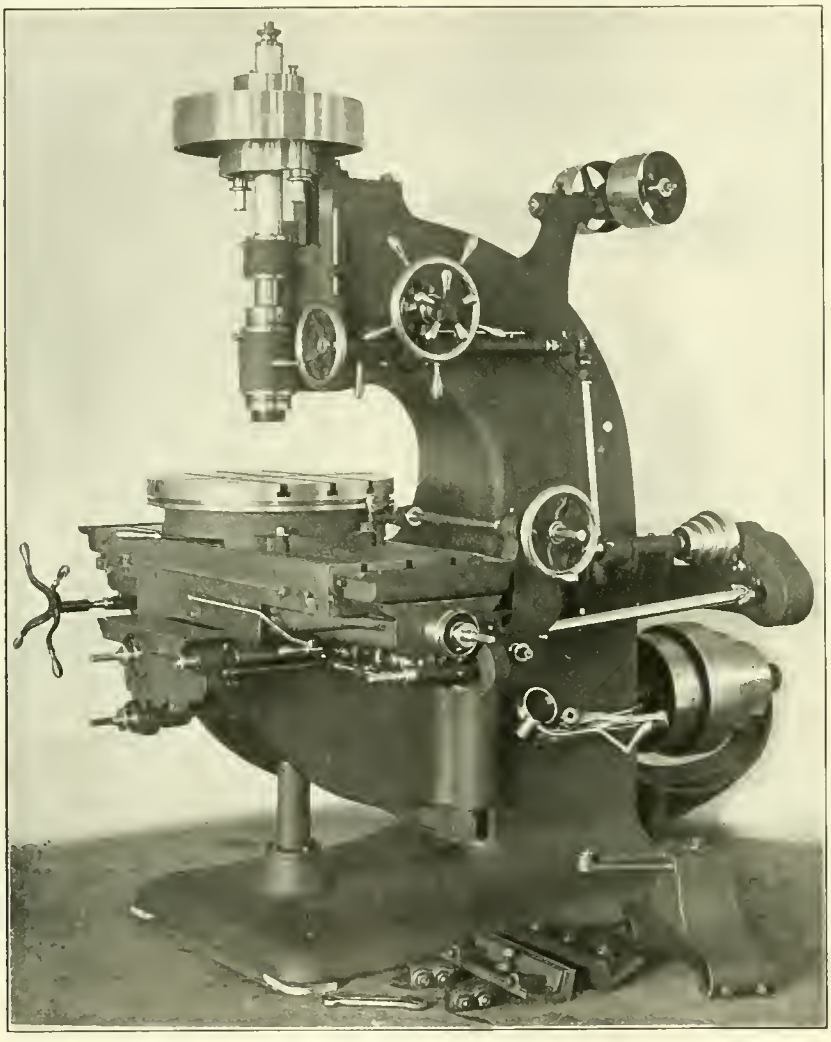
Smoke prevention or smoke combustion requires two things to ensure success, free steaming engines and intelligent, skillful firemen. A very valuable accessory is, having the coal supplied to each district of the same kind as far as possible, in order that the drafting arrangements may suit the coal and burn it economically.

Co-operation between men and managers will accomplish many things which are otherwise impossible.

A New Vertical Milling Machine.

Vertical milling machines have, as a rule, been confined to either very small or very large machines, such as are used for shaping rod ends or similar special work. This, on the contrary, is a machine for handling a great variety of work with economy, using standard or special cutters, and is sure to be more and more appreciated as it is better known.

Those who have used the end mill know the advantage of having it operate directly against the work on the table. The mill is always visible while in operation, allowing the greatest accuracy to be secured.



BECKER VERTICAL MILLER, NO. 5B.

We also show on next page three forms of milling cutters used at times.

The spindle has long bronze bearings made adjustable for wear; 3 inches diameter at main bearing; bored to Brown & Sharpe taper No. 11. Mills are secured rigidly by means of a drawbar. Large surface mills are fitted to the threaded nose of the spindle. The spindle driving pulley, mounted upon an adjustable auxiliary bearing (Becker's patent), is back geared 5 to 1; spindle pulley is 16 inches diameter, 4 inches face. To balance the action, back gears are made in duplicate.

The head has automatic or hand movement of 9 inches., and an automatic stop-dog which will throw out the feed at any point within the limit of its vertical movement, thus making this machine an excellent vertical boring machine A micrometer stop-gage located at the upper left-hand side of the frame accurately gages the depth of cut.

The platen is 51½ inches in length over all and 14 inches wide, with 42 inches automatic feed in either direction; quick return motion, geared 3 to 1; oil channels are cut into the table conducting the oil into removable oil pockets.

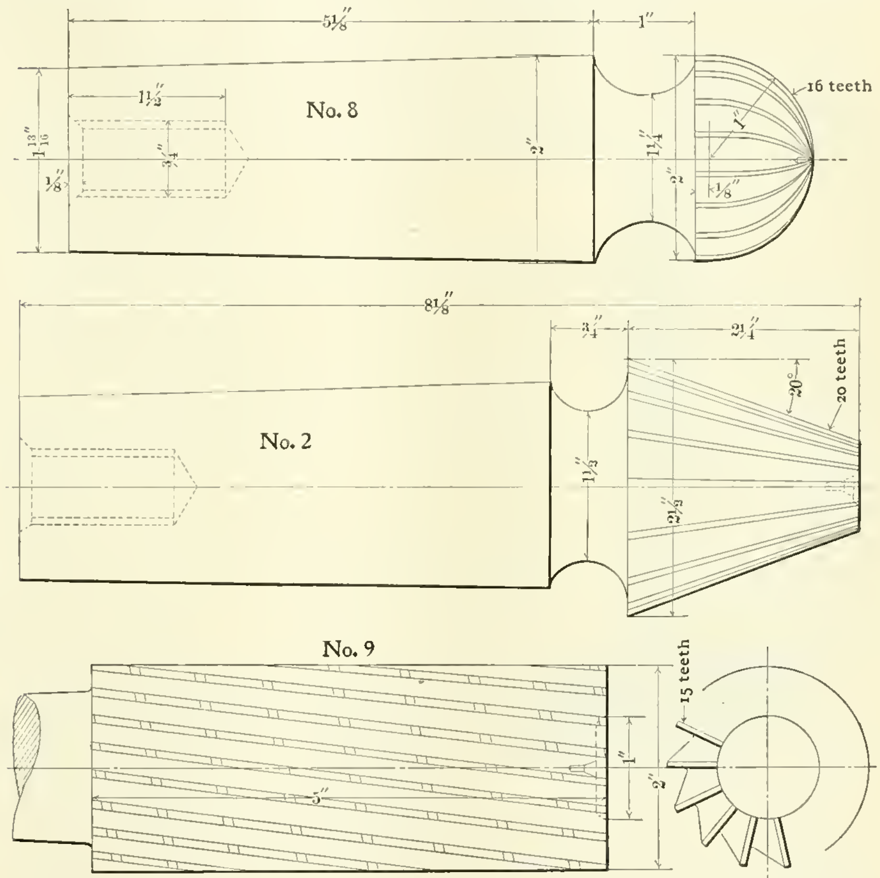
The saddle is same length as the platen, with long and slim cutters necessitates a spindle-end support.

Vise jaws are 9 inches long, 2½ inches deep, working in connection with the T-slots of the table.

Countershaft has double friction pulleys 12 and 18 inches diameter respectively, 4½-inch faces. Speed of large pulley, 400 revolutions; small pulley, 100 revolutions.

The cut shows No. 5B fitted with automatic oil pump and connections. Net weight, complete, 4,560 pounds.

The range of work that can be handled on a machine of this kind will surprise



Locomotive Engineering

SPECIAL CUTTERS FOR BECKER VERTICAL MILLER.

with automatic feed in and out of 16 inches. Both feed screws are dialed.

The knee has automatic vertical feed; extreme distance between spindle and platen, 21½ inches; between spindle and rotary table, 16 inches.

The rotary attachment has graduated table, 22 inches diameter. It is fed automatically in either direction. Adjustable dogs are attached to periphery of the table to automatically trip the feed.

Table feeds are derived from compounded gears giving 8 changes for each change of spindle speed. The intermediate gears on rotary feed bracket are interchangeable, increasing the speed 6 to 1, thus providing sixteen changes of feed for the rotary attachment.

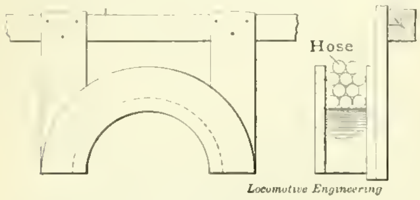
The arbor support is attachable to the knee, and is used only when side milling

those who are not familiar with them, and we have no hesitation in saying that they will be found especially useful in railroad shops. The machine shown is known as the Becker miller No. 5B, and is made by the Becker-Brainard Milling Machine Company, Hyde Park, Mass.

The enterprising general passenger agent of the New York Central Railroad is sending out highly interesting literature concerning the proposal to spend an enormous sum of money on enlarging the Erie Canal. People who wish to understand the true inwardness of that case of putting new heavy burdens upon the taxpayers of New York State should send to Mr. Daniels for the circulars about the canal scheme. It's a good thing to be posted on these questions.

A Cheap Hose Holder.

In the Valley Falls shops of the New York, New Haven & Hartford Railroad we noticed a cheap hose-holder, which, while not particularly new or novel, could be followed to advantage in many places. The cut shows it, so that few words of description are necessary. It is simply a half-hollow spool or drum, fastened to the rafters as shown, and hose hung over this



HOSE HOLDER.

will last twice as long as if left lying around on the floor. It's one of the little money-savers that save big percentages on their investment.

It looks to us as if steamboats are making much greater progress in increase of speed than locomotives are doing. With all the improvements of late years, the speed of the locomotive has not been materially increased for fifty years. The steamboats where high speed is desired have, on the other hand, been wonderfully accelerated within the last decade. The famous little torpedo boat "Turbinia" made over 30 knots an hour, and now a torpedo boat, "Viper," built for the British Navy, has made a speed of 35½ knots, or 41 miles, an hour, and there is likelihood of the vessel making a still higher speed. Both these vessels use turbine engines, through which tremendous power can be transmitted. It is expected that one of the Atlantic liners now under construction will have a speed of 23 knots, or 26½ miles, an hour.

Discussion on Pneumatic Tools.

The Institution of Mechanical Engineers and the Institution of Civil Engineers of Great Britain desire to combine with their next meetings a reception of the members of the American Society of Mechanical Engineers who will visit England shortly.

The Institution of Mechanical Engineers have arranged to hold their next meeting in London in the last week in June next, and the grand hall of the Hotel Cecil has been engaged for their annual dinner on June 27.

The meeting of the Institution of Mechanical Engineers, just past, was devoted to the discussion of pneumatic tools and power hammers. The speeches were made by the following gentlemen:

Mr. Simpson, of Pimlico; Mr. Ivatt, superintendent of the Great Northern Railway Works at Doncaster; Mr. John Fielding, of Gloucester; Mr. B. Martell, of Lloyd's Registry of Shipping; Mr. Marriner; Mr. Alfred Hanson, of Messrs. Shone & Ault, and Mr. J. W. Duntley, president of the new Taite Howard Pneumatic Tool Company, of London, and also president of the Chicago Pneumatic Tool Company, of Chicago.

Mr. Duntley said in his remarks that he had been making pneumatic tools for five years past. Perhaps it would give the best idea of popularity in the United States if he stated their output. During the first year they were in business they made 100 machines all told. Last year they averaged 800 per month. At the present time they were building new works and expected to double their production. By aid of these tools, Messrs. Cramp, of Philadelphia, had been able to overcome the results of a strike of 7,000 men, and in one ship which they had just built all the rivets were closed by pneumatic machinery. As a consequence, Messrs. Cramp had given a duplicate order for the pneumatic machines. A proof of the superiority of pneumatic riveting was given in the fact that the rivets themselves were ⅛ inch longer than for hand riveting, and this additional metal had to be closed into the holes, thus showing the latter were better filled by the use of the pneumatic riveter than by the hand hammer. Another proof was given in the cutting up of work. With ordinary hand riveting, if the ends of the rivets were cut off the shank would fall out from the holes in the plates, but when the rivets had been closed by the pneumatic machine they had to be driven out. The speaker himself was not a skilled operator, but in a contest in Germany he had beaten the hydraulic riveter; 97 per cent. of the railroads in the United States were using these tools, and the speaker gave a large number of instances in which air machines were used for superseding hand work. In the United States Government shipyards they used the pneumatic hammer for scaling ships, and it was found to be a great improvement on the old method. Another use for pneumatic machinery was in breaking up iron or steel vessels. They had what was called a "biter," or "nibbler," which chewed off the heads of the rivets, in place of cutting them by chisel and hammer. New uses were constantly being found for compressed air. In chipping stone work there had been found to be a saving of $9 a day; a rimer did the work of twenty-two men, and lately he had seen a freight car painted by compressed air in seven minutes. In this country we were in a position to appreciate what had already been done in America in the introduction of compressed air machinery. It was not always easy to get a new thing introduced, and it might be interesting to state that he had worked two years with Cramp's before he could persuade them to give him an order.

Mr. Churchward, of Swindon, said he would like to ask Mr. Duntley a question as to the staybolt biter. They had had one at Swindon for some time, but could not get it to work; the claw would not take hold for some reason. Mr. Duntley in his reply said that the action of this machine depended on the shape of the claws, and this, again, depended on the nature of the work to be done. The claw must be so arranged as to bite in. Mr. Duntley further stated that he was about to proceed to Russia to arrange for a large installation of pneumatic machinery in that country, and on his return he would be pleased to go down to Swindon and put the machine right.

Mr. Churchward further remarked that he did not wish it to be understood that he made any complaint, as the pneumatic machines did their work well, and whatever repairs might be needed were well paid for in the total result.

Western Offices of Correspondence Schools Moved.

The Chicago offices of the International Correspondence Schools of Scranton, Pa., have just been moved from the Monadnock Block, where they occupied rooms on three different floors, to the Manhattan Building, on Dearborn street, the tenth floor of which they will occupy solely, as soon as the leases of a few offices expire.

The Industrial Department will have the north end of the building. The lecture room, containing the models, sectional valves and stereopticon for the instruction of classes in the Railway Department, is on the Dearborn street side.

The Railway Department offices are on the other side; their mail address is 1005-6 Manhattan Building.

The business of the school is increasing so rapidly that more room is required to transact it properly.

Railroad Mechanical Conventions.

The Master Car Builders' and Railway Master Mechanics' Associations will meet in convention at Saratoga Springs on June 18. An experiment is going to be tried this year in holding both conventions during one week. The Master Car Builders will hold their meetings on Monday, Tuesday and Wednesday, and the Master Mechanics on the remaining days of the week. The members who attend the conventions for strict, stern business believe that holding the conventions in one week will prove highly popular. From what information cautious inquiries have brought to us, we are under the impression that the change is very distasteful to a majority of the members. Not a few of the railroad mechanical men look upon the annual conventions as the only opportunity they enjoy during the year to obtain transportation to a distance for themselves and families; and, although they are not shouting their objections from the house tops, they are by no means rejoiced at a change which curtails their holidays.

"An Angel in Uniform" is the title of a leaflet published by the passenger department of the New York Central, being a kindly notice of Alfred Booth, the courteous doorman of the New York Central station at Albany, N. Y. Mr. Booth is a very genial and accommodating old gentleman, as everybody knows who visits Albany, and the notice about him is a very pleasant, thoughtful action.

A Labor Saving Weed Cutter.

Mr. W. L. Kellogg, Sioux City, Iowa, sent us the photograph from which the accompanying engraving was made, and says: "Photo represents a weed cutter patented by E. C. Blundell, roadmaster, Chicago, St. Paul, Minneapolis & Omaha Railroad. This company have given Mr. Blundell a large order for these cutters. It is also in use on several roads in the Northwest. It is used in cutting weeds between ties. One man with this cutter can do the work of two with the ordinary

BLUNDELL WEED CUTTER.

shovel. A man in using this device can stand erect. The invention consists of a rectangular blade with four cutting edges, made of oil-tempered steel, 9 inches long, 5 inches wide, beveled from the top toward the bottom, normally horizontal with rounded corners. On a line of the greatest length of the blade and intermediate with its sides are two holes reamed out from the bottom of the blade, which is provided with a tang having a rectangular base bolted to the blade. The tang is made to receive a 5-foot wooden handle. The blade can easily be changed when worn out. The dirt or ballast which would necessarily be cast aside with the ordinary shovel in cutting weeds is allowed to remain in center of track by using this weeder."

On and after May 1, 1900, the New York offices of the Chicago Pneumatic Tool Company will occupy an entire floor of the White Building, 95 Liberty street, New York.

Meridian Shops.

The repair shops of the New Orleans & North Eastern Railway are located at Meridian, Miss. At the time they were built, in 1892, they were fairly well adapted for their purpose. They are of brick with wood framing for the roof, covered with slate, well ventilated and lighted and neatly whitewasned inside. The buildings are located in the edge of the freight yard, which makes it inconvenient.

Some new buildings are to be put up soon with some changes in the layout of the tracks. They will be as modern and up-to-date as any of their size. At present the roundhouse of sixteen stalls is of wood. Another one of brick, with thirty stalls, is to be built just outside the circle of the old one, which will then be taken away. The coal chute, of twenty-four pockets, is located close to the roundhouse, but on the main line. It is to come down and be set inside the yard, where engines can stand and take coal without blocking the main tracks. The water tank will also be moved into the yard. Cinders will be handled with an air hoist, and a new sand house with air lift is going in.

The erecting shop, in charge of C. A. Jefferis, was at one time a roundhouse. It is some little distance from the machine shop. Four of the six pits in it are drop pits large enough to take out drivers, so engines are not jacked up to get out the wheels. Later on this is to be used for coach work, as an addition is to be built to the machine shop with six pits for rebuilding engines.

Two new Heine safety boilers of 150 horse-power each have just been installed in the power house. The yards, buildings and depot are lighted with electricity. The dynamos are in the power-house, as is also a large Ingersoll-Sergeant compressor. Compressed air is extensively used all over the shops for hoists, air drills, etc., as well as to pump water from the artesian well, which is 180 feet deep. The water rises up part way to the surface, so the air pipe runs down about 100 feet and forces the water up and out of a 4-inch discharge.

The wood-working shop is on one side of the boiler room. The blacksmith shop, boiler shop, and then machine shop are on the other.

About seventy engines are looked after here by Master Mechanic C. Phillips. The system, of 550 miles, comprises three roads, the New Orleans & North Eastern, the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific. The engines of the last named road are taken care of at Monroe.

As is usual in some small shops that do not have steady work for all their special tools, there are some kinks worth noting. Having a 7-foot Niles boring mill and only one car-wheel boring mill, the large mill does duty part of the time as a wheel borer, and also is used to turn off tire when not on the wheel centers. A very effective chuck to hold tire while turning off the outside is made of a wheel center which is bolted to the face-plate or table of the big boring mill. Opposite each spoke in the wheel center—there are thirteen of them—is a slot cut crossways. The tire is dropped over the center and thirteen taper keys put in which come against the inside of the tire. These not only hold the tire from turning around, but keep in a circular shape—something hard to do with a thin tire. This home-made chuck is very handy.

The chuck for car wheels is equally ingenious. It is an old tire, just the right size to take in a 33-inch wheel, bolted to the face-plate, with three openings through this tire through which short steel blocks can slide, one end of these blocks being toothed to grip the tread of the wheel. Outside this ring is another which slides around the stationary ring and crowds the steel dogs in just like a scroll chuck.

A very neat inside chuck for holding the ball joint rings while grinding in steam pipe joints is in use here. It fits into the tool stock of an air motor. This chuck is cheaply made and very efficient. Mr. Wm. Gilmore is machine shop foreman.

Mr. Phillips has a novel design for a tender frame. Sticks of pine, 8½ inches deep by 5½ inches thick, are bolted together till a floor is made 6 feet 11 inches wide. Thirteen ¾-inch bolts hold it together. Thick pitch is put in between the pieces before being put together, which keeps out the water and makes it all solid, so it does not rot out, as might be expected if nothing was in the seams. Steel transoms are used and standard 60,000-pound freight trucks having steel bolsters and columns. A Westinghouse brake does the braking with inside hung brakes. Master Car Builders' coupler with the Butler drawbar attachment is used with this tender frame. The capacity is 4,000 gallons of water and 7 tons of coal. Five new engines have been ordered, two passenger and three freight. Three are from Baldwins; two are Richmonds.

They are now getting ready to rebuild fifteen of the old engines, making new boilers to carry 185 pounds of steam, with greatly increased heating surface over the ones now in service. Cast steel is to be used in these engines for frames, wheel centers, driving boxes, and all the other parts that it is possible to get better service out of steel than cast iron. Eccentric cams and straps are cast iron. The bearing surface used to be 3 inches wide; it is now made 4 inches wide. A few bronze straps are still used on the narrow cams. Electric headlights are on a good many of the engines. A few are added to the stock each month, till in the end all engines will be so equipped. A locomotive steam crane that can run itself around the yard and load trucks, wheels, etc., is now being built.

For loading car wheels a movable plat-

CONTENTS.

form similar to the one at Lafayette, on the Monon route, is used. It is 7 feet by 4 feet 6 inches, will hold eight wheels at a time, and is raised to the level of the car floor by two 8-inch air cylinders.

Bethlehem Steel Company, whose advertisement appears in this issue, report a very satisfactory increase in the number of railroads which are either experimenting with locomotive forgings made of Bethlehem nickel-steel, or, having satisfied themselves as to its value for the purpose, are ordering them in lots ranging from 25 to 150 pieces. The demand covers axles, piston rods and crank pins, and among the roads that are using forgings of this character may be noted the following: Atlantic Coast Line, Baltimore & Ohio, C., C., C. & St. Louis, Canadian Pacific, Chicago Great Western, Chicago, Milwaukee & St. Paul, Denver & Rio Grande, Grand Trunk, Lehigh Valley, Northern Pacific, Wabash, etc. The list is somewhat too long to be published in full, but it contains also the names of the Baldwin, Richmond, Rome and Schenectady Locomotive Works, all of which have placed orders.

The Brady Brass Company, of Jersey City, have sent to their friends a handsome leather pocket-book with the name of the recipient printed upon each book. It is an excellent permanent advertisement and keeps before the right people the address where they can write for Cypress metal.

The American Locomotive Sander Company, of Philadelphia, had on their books the first of April, for future delivery, orders for 901 track sanders.

Railway Motor Engineering is a new course of instruction offered by The International Correspondence Schools, Scranton, Pa. The course was prepared and is being kept up to date by Eugene C. Parham, superintendent of the Nassau division of the Brooklyn Rapid Transit. It is intended for operators and those who wish to become operators of electrical machinery, and contains practical instruction on the operation and maintenance of electric cars and motors. As instruction is carried on by mail, it affords a means of acquiring valuable information without obliging students to lose time from work. The International Correspondence Schools were established in 1891, and have nearly a hundred courses and over 165,000 students and graduates.

INDEX TO ADVERTISEMENTS.

Locomotive Engineering

Copyright, 1900.

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII — 95 Liberty Street, New York, June, 1900 — No. 6

Ten-Wheeler for Duluth & Iron Range Railroad.

This is a good-sized ten-wheeler just turned out by the Schenectady Locomotive Works, and gives an idea of the latest practice in engines of this type. The main dimensions follow:

Weight in working order—146,000 pounds.

Weight on drivers—16,000 pounds.

Wheel-base—Driving, 14 feet; rigid, 14 feet; total, 24 feet 7 inches.

Cylinders—19 x 26 inches.

Kind of slide valves—American.

Working pressure—200 pounds.

Tubes, number—320.

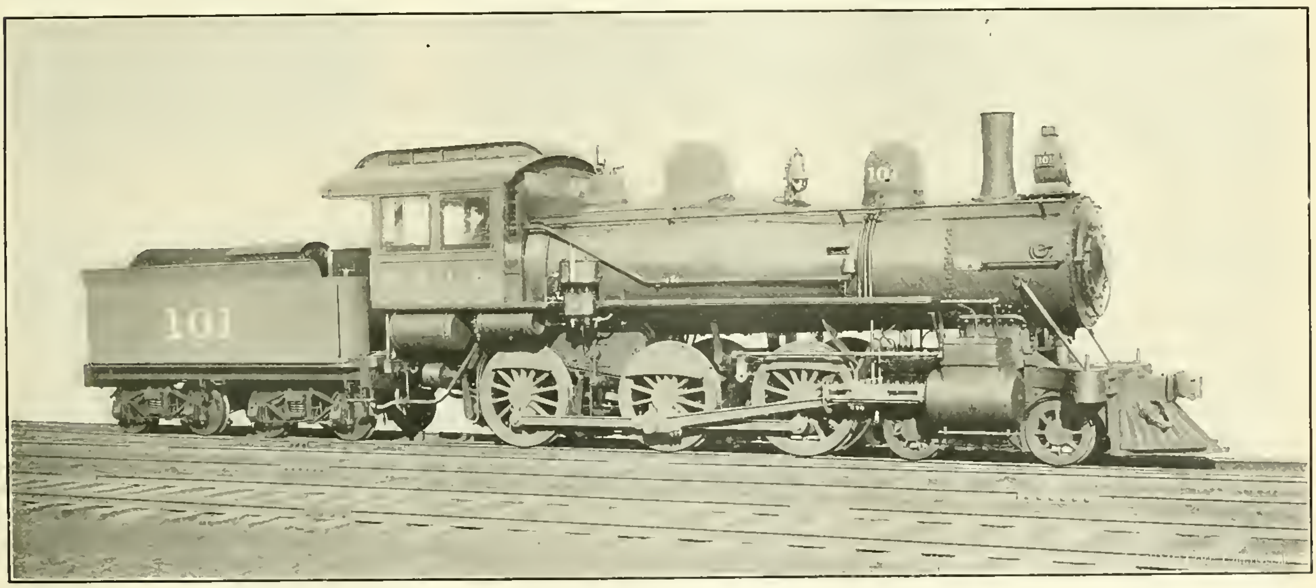
Tubes, diameter—2 inches.

Tubes, length over tube sheets—14 feet.

Heating surface—Tubes, 2,331.76 square feet; water tubes, 24.68 square feet; firebox, 156.77 square feet; total, 2,513.21 square feet.

Grate surface—27.63 square feet.

Among the equipment are: Leach sand blast, D-2, double; Little Giant bell-ringer; magnesia sectional lagging on boiler and cylinders; tower couplers at front of engine and rear of tender.



SCHENECTADY TEN-WHEELER FOR DULUTH & IRON RANGE.

Greatest travel of slide valves—5½ inches.

Outside lap of slide valves—⅞ inch.

Inside lap of slide valves—Line and line.

Lead of valves—¼ inch at 6-inch cut-off, F. and B.

Diameter of driving wheels—58 inches.

Driving journals—8½ inches diameter by 11 inches.

Main crank pin journals (main side, 6½ x 4 13-16 inches)—6 inches diameter by 6 inches.

Side rod crank pin journals—F. and B., 4½ inches diameter by 4 inches.

Truck journals—6 inches diameter by 10 inches.

Truck wheels—30 inches.

Outside diameter of first ring—62 inches.

Sacrifice to the Engine God.

India is a country where the gross superstitions prevailing among the natives frequently produce the most horrible and inconceivable tragedies. Many of these are done in secret, but now and then they come to light, and give a startling reminder to the Englishmen in India that "East is East and West is West, and never the twain shall meet." In the up-country town of Hingoli, in the Deccan, is a cotton-ginning mill owned by natives. One of the proprietors, a Parsee named Nowrojee, looks after the engines and machinery of the mill. Lately the machinery has not been working well, and the engine in particular has given considerable trouble. The native engineers seem to have got it into their heads that the engine was really driven by a god which took the form of steam. When it went wrong they thought the god was angry and needed propitiating by the sacrifice of a human being. One night a Hindoo laborer named Govindah was passing the mill. Some workmen, sitting in the yard smoking, called out to him to join them. The gang had just been discussing the vagaries of the engine and the necessity of offering a sacrifice to it. The whole party walked toward the boiler, and some of the men seized Govindah. Others swung open the furnace door and the unfortunate man was crammed inside, head first. They had to loose their hold of his body in order to shut the furnace door, whereupon Govindah, who was a very powerful man, managed to get out and free himself. He was frenzied with pain and fear, and had sustained ghastly injuries. The engineers did not make a second attempt to thrust him in the furnace, and he crawled away to his hut.

A group of heavy consolidation and twelve-wheelers are being built at the Rhode Island Locomotive Works for the Fitchburg Railroad. The Schenectady Locomotive Works have purchased forty old locomotives from the New York, New Haven & Hartford Railroad for scrap iron.

The Newfoundland Railway and Its Owner.

Newfoundland, Great Britain's oldest colony in the Western World, was discovered in 1497 by John Cabot, one of England's great navigators. The colonization of the island was of slow growth; the adventurous spirits who came from the motherland devoted themselves entirely to the fishing industry. Burns, in his "Twa Dogs," refers to the island as:

"Some place far abroad,
Where sailors fish for cod."

The settlements were located in the numerous bays with which the island is so plentifully provided. Access from one to the other was by the water route; consequently the interior of the island was but little known. This state of affairs prevailed for many years. However, as the population increased, more attention was paid to the interior of the country. It was found that Newfoundland had within its borders vast mineral deposits and some good agricultural lands. To properly develop the resources of the island, a railroad was necessary; therefore in 1880 a company was formed and an elaborate railway system for the island was mapped out; the result of which was the building of some 80 miles of road, which was run for several years by the company, and finally bought by the Colonial Government, which also owned the telegraph and cable lines of the island. In the course of time the government found that owning a railroad was an expensive luxury. The country was in need of more lines of railway, but the government did not have the necessary money to build them, and wisely came to the conclusion the best thing to do was to sell out their railroad, telegraph and cable lines.

A few years ago a purchaser was found in the person of Mr. Robert Gillespie Reid, a gentleman of large fortune and experience as a railroad and bridge builder. It would be beyond the bounds of this article to give a list of the many large bridge and railroad contracts Mr. Reid successfully carried out, both in the United States and Canada. Suffice it to say that after Mr. Reid bought out the railway system of Newfoundland, with which went the telegraph and cable lines, also the magnificent dry dock at St. Johns, he immediately set about improving and extending the railway and his other properties. Probably to-day Mr. R. G. Reid is the only man in the world that can affix his name with the word "owner" of a railway system of 640 miles, a fleet of eight magnificent steamers, all the telegraph and cable lines of Newfoundland, the great dry dock and tramway lines of St. Johns, the capital city of the island. His mineral and agricultural lands are numbered by the million of acres—all of this in the business world. In the financial world he has reached the highest altitude that can be achieved in British America—he is a director in the Bank of Montreal.

RAILWAY BRIDGE—LITTLE CODROY RIVER.

As to whether Newfoundland has done well by Mr. Reid remains to be seen; but it is quite evident Mr. Reid has done well for Newfoundland. His business enterprise is apparent on every hand; he has given it a railway system far ahead of any other British American possession outside of Canada. By his railway and steamship lines he has brought the island in close touch with Canada and the United States. He has given St. Johns a splendid electric tramway and a fine new hotel, two things which were much needed in St. Johns. I am informed that in the near future Mr. Reid intends building a large shop at St. Johns for his railway and steamship work. This will be located close to the dry dock, and no doubt, when completed, will be up to date in all particulars.

Mr. Reid's vast properties in Newfoundland are ably managed by his three talented sons. Mr. W. D. Reid is general manager, H. D. Reid assistant manager, and R. G. Reid, Jr., general superintendent. Those young men have had a thorough training in all things pertaining to railway construction and railway management, under the careful tuition of their capable father, and it is a question if any of their numerous employés devote more time to business or work any harder than those young men do, who are prospective heirs to millions. They are courteous gentlemen, liberal in their treatment of employés. Many a poor family in Newfoundland has cause to bless the munificence of the Messrs Reid.

FISCHELS BROOK BRIDGE AND GYPSUM CLIFFS.

The Newfoundland railway system is 3-foot 6-inch gage; the new equipment is thoroughly up to date; the sleeping and dining car service is excellent. The same can be said of the steamship service. Travelers or tourists who make the trip on the A1 steamer "Bruce," between Port au Basques and North Sydney, N. S., consider the 93-mile journey too short to fully enjoy the pleasant surroundings found on the "Bruce." Her genial commander, Captain Delany, is one of the best known navigators in Newfoundland. Tourists to Newfoundland—and they are getting quite numerous in the summer season—will find the Captain a veritable mine of information in regard to the best fishing and hunting resorts on the island. They are numerous, but he knows them all.

ROBERT GILLESPIE REID.

What is said of the "Bruce" and her captain might also be said of the other steamers of the fleet. Probably the most delightful summer excursion that can be taken is a trip from St. Johns to the Labrador Coast. For variety of scenery it is unexcelled, and getting among the quaint people, the Labrador Esquimaux, or Fnuits, is truly a glimpse of primitive humanity.

When the list of eminent men of the nineteenth century is completed, Mr. Robert Gillespie Reid should have a prominent place. Mr. Reid is a Scotchman by birth, and, like his great countryman Andrew Carnegie, is a self-made man. From a small beginning he has achieved greatness by honest industry and business integrity. He is yet a comparatively young man. Nobody knows R. G. Reid but wishes that he may live for many years to enjoy the fruits of his well-merited fortune.

To be the Fastest Ocean Greyhound.

We understand that the North German Lloyd Steamship Company have ordered a new steamer to be built at Stettin, that will be 752 feet long, making her the largest vessel afloat, and that the calculated speed will be at least 24 knots per hour. This is about 26.7 miles an hour. The vessel will be driven by twin screws, 25 feet in diameter, and engines of over 40,000 horse-power will keep the screws turning. The power applied to this vessel will equal that of about forty consolidation locomotives. It is expected that the steamer will make the run from Queenstown, Ireland, to Sandy Hook in a few hours short of five days. The best voyage on that route, made by the "Lucania," of the Cunard Line, is 5 days 7 hours and 23 minutes. Over the route of 3,050 knots from Southampton to Sandy Hook the new unnamed space-annihilator, going at the rate of 24 knots an hour, would make this port in 5 days and about 7 hours.

After the great ship is in service we may expect to hear that the Hamburg-American Line has another colossus under way, designed to make, maybe, 25 knots an hour. This will somewhat confuse the nautical prophets, who have been declaring for the last several years that the order of the future on commercial seas would be big ships of great cargo capacity and moderate speed. The prophets who are not nautical say look out for the 1,000-foot liner of 30 knots.

Finland State Railway.

The Finland State Railway continues to order locomotives in this country, and this is one of the latest, sent by the Baldwin Locomotive Works. The general dimensions are:

Cylinders—16 x 20 inches.

Gage—5 feet.

Valve—American balanced.

Diameter of boiler—48 inches.

Thickness of sheets—½ inch.

Working pressure—180 pounds.

Fuel—Coal.

Firebox—Copper; length, 60¾ inches; width, 36¼ inches.

Tubes—130; diameter, 2 inches; length, 11 feet 10 inches.

Heating surface—Firebox, 70.62 square feet; tubes, 796.21 square feet; total, 866.83 square feet.

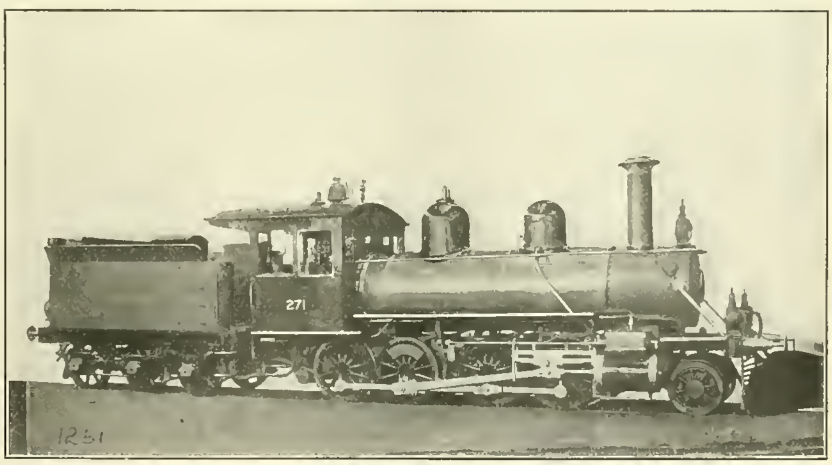
Grate area—14.8 square feet.

Driving wheels—Diameter outside, 44 1-10 inches; journals, 6 x 8 inches.

Engine truck wheels—Diameter, 31¼ inches; journals, 4½ x 7½ inches.

Wheel-base—Driving, 12 feet 6 inches; total engine, 19 feet.

Weight—On drivers, 71,905 pounds; on truck, 10,600 pounds; total engine, 82,505 pounds.



BALDWIN LOCOMOTIVE FOR FINLAND STATE RAILWAY.

Trains and the Louisiana Purchase.

An interesting fact in connection with the new overland train which the Burlington is about to put into service between St. Louis and Puget Sound, by way of Billings, Mont., is that for nearly the entire distance of 2,500 miles it will run through country acquired by the United States at the time of the Louisiana purchase in 1804. When Napoleon Bonaparte, on behalf of France, sold the territory to us for about 2½ cents an acre, he little dreamed, in his endeavor to annoy England, what a magnificent empire he was practically giving away.

On ordinary highways the cost of haulage is about 15 cents per ton per mile. Railroad companies have to pay all operating expenses and return some profits to the stockholders while charging half a cent per ton per mile.

The new addition to the shops of the Newton Machine Tool Works, Philadelphia, Pa., will give them about three times their present capacity. This will enable them to handle work to better advantage. Their latest designs in the way of portable (?) tools is a slotter for the Westinghouse Electric & Manufacturing Company, for use on the large generators for the Manhattan Elevated. This machine will weigh 50,000 pounds.

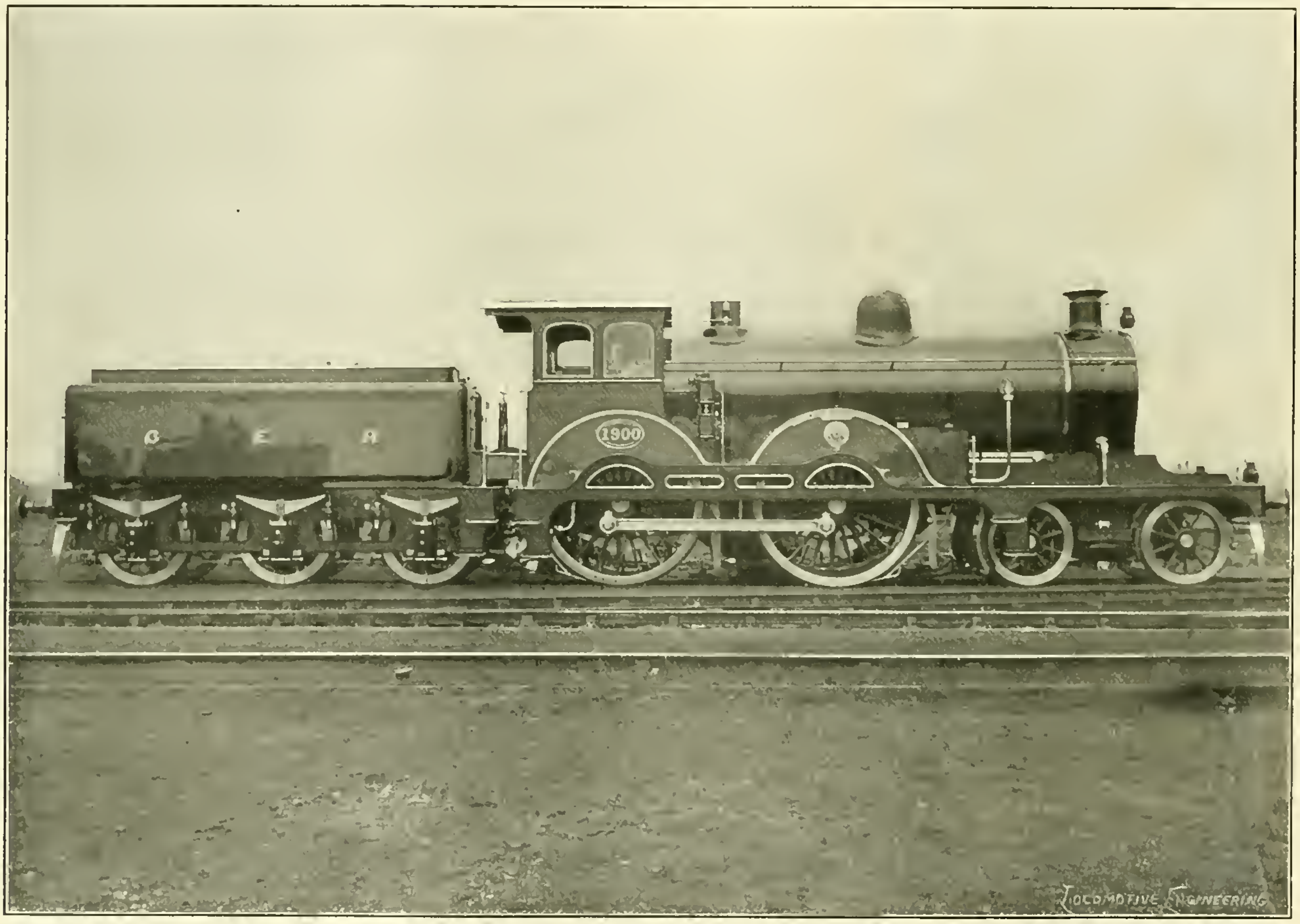
Great Eastern of England Express Engine.

St. Patrick's Day, 1900, was a memorable day at Stratford, a suburb of London, says the *Locomotive Magazine*, as witnessing the completion of the magnificent four-coupled bogie express locomotive which has been designed by Mr. James Holden, locomotive superintendent of the Great Eastern Railway. The engine, which is named the "Claud Hamilton," after Lord Claud Hamilton, president of the company, is hereby illustrated by a fine half-tone engraving made from a photograph sent us by Mr. F. Moore, our London agent, the publisher of the *Locomotive Magazine*. The engine is intended for use in pulling the heavy main line passenger express traffic, and will be shown at the Paris Exhibition, where we are certain the harmonious proportions will attract the attention of all railroad men who like to look at a handsome machine.

The following description is taken from the magazine named:

"The cylinders, which are arranged with the valve chests underneath, are 19 inches diameter by 26 inches stroke. The diameter of the four-coupled drivers is 7 feet, and of the four truck wheels 3 feet 9 inches. The truck wheel base is 6 feet 6 inches, from truck center to driving center is 11 feet 3 inches, and the coupled centers are 9 feet apart, the total wheel base being 23 feet 6 inches. One of the best features of the engine is its very large boiler, which has a maximum external diameter of 4 feet 9 inches and is 11 feet 9 inches long, while the firebox is 7 feet long and 4 feet ½ inch wide outside. Two hundred and seventy-four tubes of 1¾ inches in diameter provide a heating surface of 1,516.5 square feet, and the firebox gives 114 square feet, the total heating surface thus being 1,630.5 square feet. The working pressure is 180 pounds per square inch, and the area of the fire-grate 21.3 square feet.

"The engine is fired with oil on Mr. Holden's well-known system, the burners being provided with an auxiliary oil fuel supply, enabling much larger quantities of oil to be sprayed without increased expenditure of steam. The air inducing rings are also of modified form, whereby their efficiency in atomizing and distributing the oil fuel spray is considerably augmented. The arrangement of air heating in the smokebox is novel too, as compared with that of the No. 10 class, consisting, as it does, of a series of vertical tubes placed down the sides of the smokebox, and receiving the air supply from an opening at the bottom below the smokebox door. The engine is fitted with a novel and ingenious air reversing gear, which can just be seen in the illustration through the cab window. The cab is very large and roomy, and the special equipment includes Stone's double sight-feed lubricator, the Exhaust Steam Injector Company's patent exhaust injector, steam sanding gear, Westinghouse brake, etc. The tender runs on six 4-foot wheels, with a wheel base of 13 feet. It will carry 2,790 gallons of water, 715 gallons of oil fuel, and thirty hundredweight of coal, and is fitted with a scoop for picking up water while running, operated by an ingenious arrangement through the medium of compressed air."



GREAT EASTERN OF ENGLAND EXPRESS LOCOMOTIVE.

Some people expend a great deal of money on advertising and yet obtain very little return for their enterprising policy. The cause of this unsatisfactory result is often that there is not life enough in the advertisements. The rule is to put in a stereotyped announcement and leave it without change. To those who are anxious to reap a proper return on their advertising outlay we would say, study the methods of the Joseph Dixon Crucible Company in their advertisements in LOCOMOTIVE ENGINEERING. The Q. & C. methods might also be carefully noted. There are others who use living advertisements, and they never complain that advertising does not pay.

Double Deck Boarding Cars Built by and in Use on the St. Paul & Duluth R. R.

We are indebted to Mr. Geo. D. Brooke, master mechanic, for blueprints, photographs and the following description of these cars:

KITCHEN CAR.

"Heretofore the boarding trains in use on this road for rail-laying and construction gangs have been a conglomeration of our smaller cars, which as a rule were in such poor condition that it was not considered advisable to go to the expense of equipping them with air and couplers.

"It then becomes necessary to secure a substitute, and the blueprints and photographs accompanying show clearly what was decided upon. The problem was, to take care of about sixty men in units of two cars each, give them comfortable and clean quarters so as to secure and retain a desirable lot of men, diminish the side-track room necessary for setting them out, and by compactness bring the men closer under foreman's discipline after working hours. We found that we could arrange for this number of men in units of two cars each, and if any class of work required more men, two units or four cars could be used, and still leave the outfit so arranged that one unit could be moved on short notice, especially at night, with great convenience, in case they should be needed suddenly for wash-outs or other trouble.

"The general exterior dimensions of these cars are as follows: Length, 40 feet 8 inches; width, 10 feet; height, 16 feet 3 inches above rail to running board.

"One car, called the kitchen car, has the lower floor fully equipped with range, large ice-chest, hot water tanks and other necessary appliances. One end of lower floor is partitioned off for foreman's office and dining room, which is also used by the train crew.

"Above kitchen is the cook and helper's berths and full storage room. Above the foreman's office are the sleeping accommodations for himself and train crew.

"The other car of the unit has lower floor entirely taken up as a dining room, with loose tables and benches, so that it can be used as a lounging room during stormy weather and at night. The upstairs is used entirely for sleeping accommodations, and will take care of forty-eight men. The dining room will seat fifty-six men at one time and leave a free aisle-way for the cook's servers during a meal. Great care has been taken to secure good ventilation, each double berth having a half window that can be raised or lowered to suit the occupants of that berth. There is a stairway at each end of each car; but to guard against a sudden fire, there are end doors and convenient stationary ladders on the second floors.

"As these cars present quite too large a surface to Minnesota winds, when they mean business, for the narrow wheel-base to furnish secure enough foundation, a method for securing guy lines has been arranged for at each top corner of cars.

"These boarding-train units, each taking the place of from seven to nine cars as formerly used, gave such satisfaction to the engineering department last season that they are asking for more of the same kind

"We have only found it necessary to make one addition to the convenience and comfort of these cars since photographs were made, and that consisted in putting a large hood over cooking range, to carry the heat and steam up through the second floor and roof, with a removable extension pipe above roof to assist in inducing an upward current or suction.

"On account of the height of these cars, they are of necessity confined to our line, which fortunately has head room sufficient at all points."

INTERIOR OF KITCHEN.

The Illinois Central Railroad are making a test of fine coal made up into a compact lump of suitable size for firing, which will utilize the coal dust that now goes to waste. Just how it will compare with coal fresh from the mine we can tell later on. So far it does not show any smokeless qualities not possessed by the coal before being made into coal bricks.

The United States Metallic Packing Company are feeling very pleasant over orders from the Paris & Orleans and the French State Railways for packing. They also expect to have their packing on practically every engine in the American exhibit at the Paris Exposition.

A Cast Iron Milling Tool.

Milling tools are usually made of the best of steel, very carefully machined, and care taken in hardening them, so they can be trued up with little loss of metal on the cutting edges. This makes them expensive, especially the large ones.

Master Mechanic M. L. Flynn, of the Michigan Central Railroad at St. Thomas, Ontario, has been using cast-iron millers for some time past and finds them much cheaper than steel ones, and just as reliable.

These milling wheels are cast of ordinary car-wheel iron, in an iron chill, which is cut out to give the teeth the right shape and pitch. The center is first bored out the proper size to fit on the mandrel or arbor, the cutting edges then ground on an emery wheel, and they are ready for use. These tools cost about 3 to 4 cents a pound when completed.

Some of these cast-iron millers are as small as 4 inches in diameter. One, used for milling out the inside of wedges and shoes, where they fit against the jaw of the frame, is 8 inches in diameter. It has cutters on each end as well as on the side, and finishes that part of the wedge on three surfaces in one trip. Thirty-two of these wedges can be milled out with one tool before it needs grinding. These tools will cut cast-steel boxes also in good shape, and make good reamers. It is quite a job to cast these tools and have them straight and free from cracks. Shop Foreman J. H. Sherman, who invented them, has made a study of the work in the ten years they have been in use, and gets out good castings every time, unless they are very large.

Quite a number of new engines are built at this shop, both heavy ten-wheel engines and six-wheel switch engines. Some of the material, like frames, etc., is bought on the American side. The tariff cuts quite a figure in the relative expense of engines built in the company's shop or imported.

The best use for a 6-inch air pump is, trading it in to the brake company for a new one of improved design. Occasionally we see one that is taken out of air-brake service and put at other work. Mr. Flynn has one mounted on a truck, so it can be wheeled around the roundhouse and shop for use in testing boilers. The air end is bushed down to 3 inches; water-hose connections are coupled on, after the boiler is full; the pump is operated with air and can be very easily regulated to raise the pressure either fast or slow. The exhaust is not any trouble to the workmen in the shop, as a steam pump might be.

SLEEPER AND DINING CAR.

Clean Switch Targets.

It is customary to paint switch targets and semaphore blades about once a year, but they do not hold their bright, fresh color very long. Smoke and dirt soon change the welcome bright color to a dingy one which cannot be made out very clearly except at close distances.

There is a great difference on the various railroads of the country as to keeping targets clean and bright; some always look clean, others are the reverse. Targets that are down close to the ground get the greasy water from the cylinder cocks. This with the dust soon spoils the color for signal purposes. The water thrown out of smokestacks is not much better.

If these targets were washed off clean at intervals during the year, it would change their appearance for the better. Lenses in lamps are cleaned every day or two; now, why cannot the targets be cleaned by washing off at least once a month?

These remarks are called out by seeing a signalman thoroughly washing all the targets under his charge. They looked as good as newly painted. This with a background of dirty box cars helps out when catching the position of switches.

After all, it is better to depend on the shape of the signal blade than on its color; the shape does not change, while color does.

"The Lehigh Valley Railroad as Seen from the Train" is a neat little folder just issued by the advertising department of the road. It is both artistic and useful, as it gives the main facts of the important towns along the route, which is sure to interest a traveler.

INTERIOR OF DINING CAR.

Gould & Eberhardt, of Newark, N. J., have issued a very neat catalogue of their Victoria gear cutter. This appears to be a thoroughly up-to-date machine and one which every mechanic should be familiar with. Copies will be sent on application.

He Changed the Line.

The engineer who lays out a railroad dislikes to move a stake when it has once been driven.

Once, when the present chief engineer of a Western railroad was locating a line in Missouri, he was asked to change the stakes, and refused. After the stakes had been set, a young, unshaven man appeared and asked that the road be "moved over a bit."

"The road cannot be changed," promptly returned the engineer; "this is the best place for it."

The man went into a house, got a rifle, came out, and pulled up the stakes. The indignant engineer started toward him, but was intercepted by an elderly woman.

"Can't you move your road over a little piece, mister?" she asked.

"I don't see why I should," responded the engineer. "My business is to locate the line, and you can call on the company for damages. What does that young blackguard mean by sitting there on a stump with a gun?" he angrily demanded.

"That's Nip; he ain't no blackguard. That's Nip, my son."

"Well, I'll nip him if he gets funny."

"Oh, no, you won't. I ain't afraid o' that," said the woman. "What come over me when I seen you starting for Nip was that p'r'aps you had a mother, and how bad she'd feel to have you come home that way."

"What way?"

"Well, if you persist in driving them stakes there you'll go home dead."

"Look here, do you think I'm to be bluffed by that ruffian?"

"Nip ain't no ruffian," said the woman. "You see, we've always lived here—Nip was born here—an' when the guerrillas come an' called out paw an' shot him we buried him jist whar he fell, an' we've always kept it as a reservation, an' Nip, he's determined you sha'n't disturb it; that's all."

"Then you don't object to the railroad?"

"Lord o' mercy, no! We want the road, but we don't want you to disturb paw's grave."

"Come," said the engineer, "let's go and see Nip."

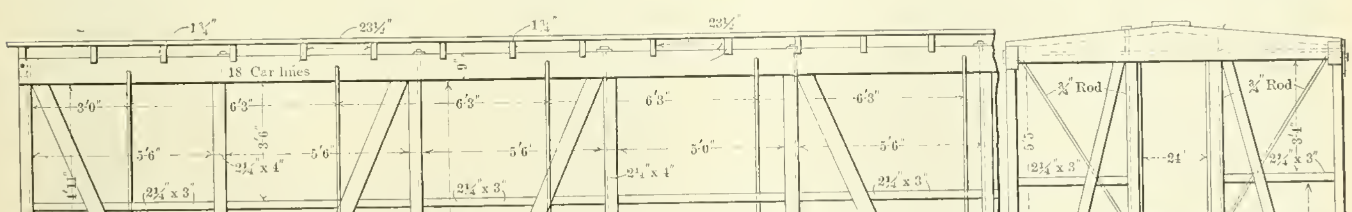
When they had come up to the stump the big engineer held out his hand. Nip took it, but kept his eyes on the stranger.

"Here it is," said the woman, touching a low stone lightly with her foot.

"I see," said the engineer. "We can miss that easily enough."

He moved a mile of road. From that day forward until the road was finished, and long after, the widow's home was the stopping place for the engineer.

SLEEPING APARTMENTS OVER DINING ROOM.



People using lathes can hardly imagine the possibility of doing heavy accurate work without the aid of a slide rest. Yet the slide-rest invented in England by Maudsley was not brought into use until about 1820, and it was not introduced into the United States till three years later. It was taken hold of and simplified by Rufus Tyler, an expert clock maker in Philadelphia, and the work done with the slide-rest in his shop did much to push the device into popularity. Within a few years it was used more extensively in the United States than it was in England.

We have heard a great deal of complaint lately among engineers that the cylinder oil supplied lacks the viscosity that good grades of valve oil used to have. They say that it is not of a clinging nature, not of the viscous, adhering, film-forming character that the oil was which kept valve faces and cylinder surface shining like bright silver. When we listen to that kind of complaint we are inclined to ask, Do you put soda in your feed water? Alkaline water destroys lubricants, and it does not tend to polish rubbing surfaces.

Welding Locomotive Frames in Place With Oil.

BY D. P. KELLOGG.
(Foreman Southern Pacific Railway, West Oakland, Cal.)

Enclosed please find print, photographs and description of welding frames without removing them, a system we have followed for the past six months at the West Oakland shops of the Southern Pacific Company. From a comparison of cost and the saving of time, and durability of service, we have reached the conclusion that the process is, or will be, entirely successful.

The advisability of using this method for welding frames, flues and other work has been much discussed in local circles, and opinions for and against freely expressed, so that we have deferred a description until judgment had been passed by the great and celebrated judge of all events—time. At least a partial decision has been handed down, as the first weld of this nature was made on engine No. 1304 on November 11, 1899, as shown by the accompanying sketches.

This was an expansion weld, as the frame was blocked to prevent its going endwise when heated and brought up to the welding point, which upset it about 3/8 inch between the jaws, and it was then hammered and finished in the usual manner.

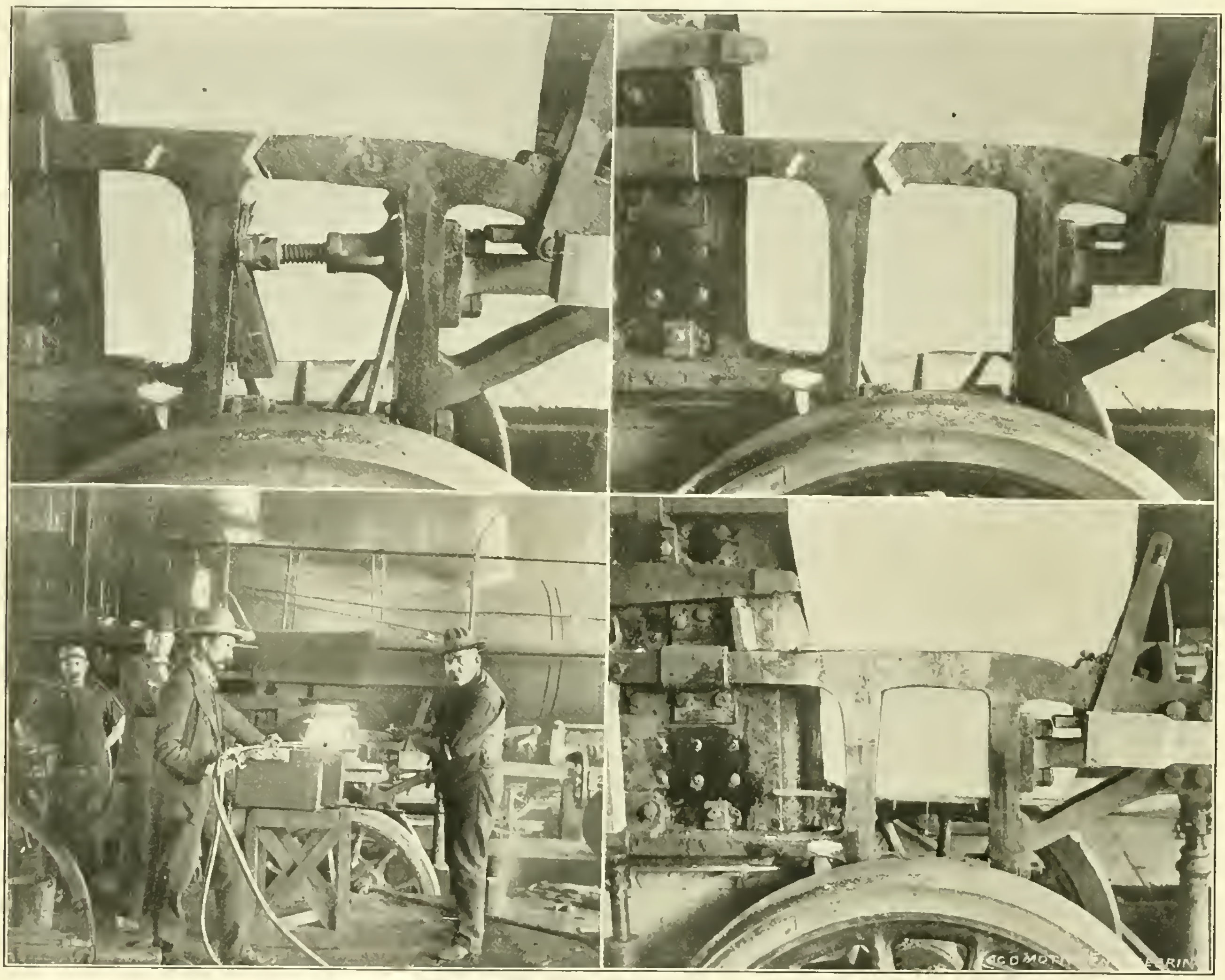
Experience has taught us that this class of weld can be better done by the method followed on engine No. 1334, which will be explained later. The only objection, however, being that it necessitates planing of the shoe and wedge.

The next attempt was made on engine No. 1502 (No. 2 on sketch), which broke twice in succession after running thirty days. The first time the old piece was rewelded, and broke from the original cause—weakness. We then put on a new piece, and that broke thirty days later, showing a poor weld and that we had a foreign substance between the pieces. We next put on a new jaw, which gives every indication of being satisfactory after five months' service. Another weld of the same kind on engine No. 1504 (Fig. 6) has run four months without a sign of fracture.

It might be said, to offset the experience just related, that the frames on this class of engines, seven in number, have broken before in the same place with persistent frequency, five of them having broken in the past year, besides the two that were welded with oil.

Nos. 4 and 8 are what we call the easy ones, one reason being that 1-32 or 1-16 inch in length is of slight consequence; another being that we are able to drive the bottom of the jaw up with the pneumatic hammer (which is a first-cousin to the "Cannon" used in some shops), which is a great persuader when an upward blow is required.

We will describe this weld in detail, which will serve to explain them all, as far as the welding goes:



WELDING A LOCOMOTIVE FRAME IN PLACE WITHOUT TAKING DOWN—SOUTHERN PACIFIC SHOPS AT OAKLAND, CAL.

First, we jack the top and bottom frames apart and insert 3/4 or 1 inch of metal (grain corresponding) in the fracture, then remove the jack from between the frames and place it under the bottom frame and jack it up against the upper half. While the inserted piece is red hot we then strike the jaw on the lower end with the hammer, which forms the inserted piece to the fracture. This piece extends beyond the jaw on the four sides 1/2 inch. We then put up a sheet-iron platform, that may be readily knocked down, on which we build a small firebrick or arch-brick furnace, using fireclay instead of mortar, exposing about 4 inches of frame to the fire. We then light the fire and bring the heat up gradually, using about forty minutes on a 4-inch frame, so that it may be thoroughly heated through, and when it nears the welding heat the blast is increased. It is then driven together from the bottom, then hammered on the front side with the remodeled Ingersoll-Sergeant rock drill with 4½-inch piston, which strikes hard enough to work the iron to the center. We then go to the opposite side of the engine and remove a brick from the back side of the furnace, through which we again hammer the back or inside of frame with the drill, or a ram may be employed for this purpose. The furnace is then knocked down, and the remaining two sides are hammered up with sledges. One of the advantages of this method is that all the work, except two sides, is finished while the fire is still burning and the iron dripping hot; another is that there is no chance for dirt to get in the seam before welding takes place. For a flux we have recently used the Cherry-heat welding compound, which gives good satisfaction and prevents wasting, but is not absolutely essential.

Nos. 9, 10, 11 and 12 are also comparatively easy, as in this case we drop the shoes and wedges, remove the deck bolts and jack the frame apart enough to insert the piece we wish to put in, and after the heat is brought up, we drive it together with a ram and treat as before described.

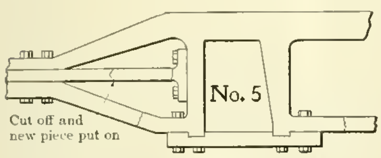
Referring to the photographs, No. 1 shows a frame which was cracked a little more than one-half from the under side. We then sawed down from the upper side, which formed the V, jacked the jaws apart and inserted the piece as shown in No. 2. No. 3 shows the job and operator with the frame at the welding heat; Mr. T. O'Leary on the right and Mr. P. Noone, his helper, on the left, who have made all these welds, except the first one, which was made by the author and Mr. H. H. Hale, roundhouse foreman. No. 4 represents the finished job, and No. 5 the tools used. The tank on wheels and connections with the burner on the end of the ¼-inch pipes is used for a variety of purposes, such as straightening and welding frames of both tenders and locomotives, straightening front ends, kindling fires and putting on and taking off tires.

The total cost of completing the job shown by the photographs was $21, and the time would not have exceeded fifteen hours from the time the engine came in until it was ready to go out, had it not been for other work.

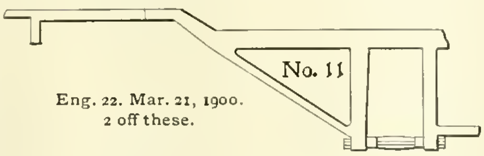
We also weld flues with crude oil, and with the price of oil and coal in California, the cost is greatly in favor of oil.

The saving of cost and time will be apparent, and should be appreciated by those who have a broken frame and are hard pressed for power.

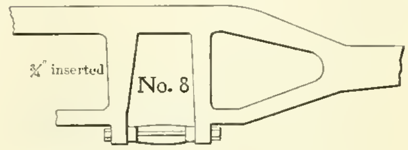
It would seem that this process might be used on ships at sea, or bridges, or heavy structures in place Neither the process nor the burner is patented, and we hope it may prove interesting to our railroad friends.



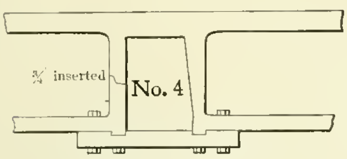
Eng. 1322. Dec. 11, 1899.



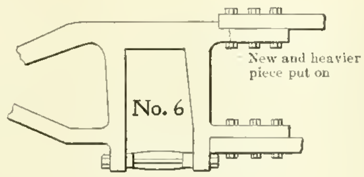
Eng. 22. Mar. 21, 1900. 2 off these.



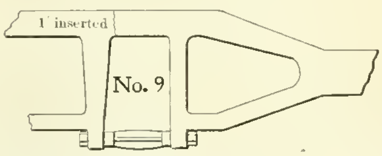
Eng. 1263. L. M. Jaw, Jan. 1900.



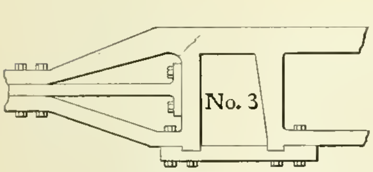
Eng. 1562. Dec. 8, 1899.



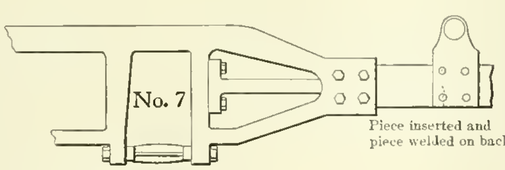
Eng. 1504. Dec. 22, 1899.



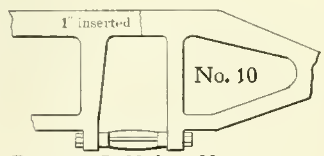
Eng. 1592. R. Main, Feb. 12, 1900.



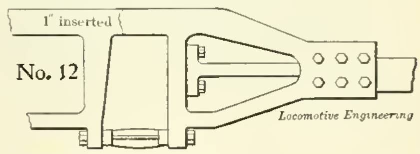
Eng. 1348. Dec. 4, 1899.



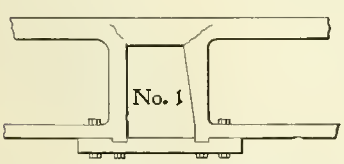
Eng. 1304. Dec. 28, 1899.



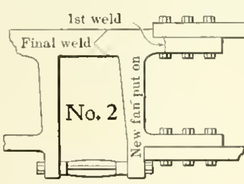
Eng. 1109. R. M. Jaw, Mar. 15, 1900.



Eng. 1334. April 10, 1900.



Eng. 1304. Nov. 11, 1899.



Eng. 1502. Nov. 29, 1899.

Mr. H. Stillman, engineer of tests, Southern Pacific Company, has made a number of tests of axles welded by their own expansion, and by searfing and hammering in the usual manner, and found but little difference in quality of work, while the quantity and cost were in favor of oil. The results of one of his experiments, in a report to Mr. H. J. Small, superintendent of motive power, Southern Pacific Company, are appended.

REPORT ON OIL BLAST AS COMPARED WITH COAL FORGE.

Sacramento, Cal., April 12, 1900.

Mr. H. J. Small, Superintendent of Motive Power:

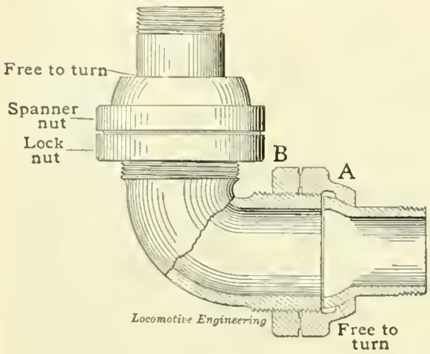
Dear Sir—The following are tests of iron welds made with oil blast as compared with similar welds made in ordinary blacksmith forge using coal. All welds were made from lengths cut from same bar, 1½ inches round. The oil-welded bars were made at West Oakland with Coalinga crude oil. The coal welds were made at Sacramento shop. Scarfing for all welds were made in a similar manner.

No of Test.	Kind of Weld	Fuel	Dia of Test Section in Inches.	Tensile per Square Inch in Lbs.	Per Cent. Elongation in 8 Inches.
1	M & F. Scarf.	Oil.	1.328	49084	10.6
2	" "	"	1.375	4 465	8.2
3	" "	Coal.	1.375	50842	13.
4	" "	"	1.375	50559	11.7
5	Lap Weld.	Oil.	1.375	45603	7.0
6	"	Coal.	1.375	40485	4.1
Average of Oil Welds				47051	8.6
Average of Coal Welds				47295	9.7

Test section in above bars was 8 inches

long, including the welded portion at center. All fractures showed a trace of crystallized iron, and the results are somewhat low for welded bars. This is probably due to the fact that the original bar was not first-class iron, though this would not affect comparative results. Tests Nos. 5 and 6 showed unwelded iron at the fracture, the coal weld No. 6 being the poorest. Including this poor weld (No. 6), the average of coal-welded bars shows a slight advantage in functions of strength and ductility.

It was noted during the process of oil-



FLEXIBLE METALLIC JOINT.

welding that there was considerable scaling of the iron surfaces at high temperatures, due to direct contact of the blast. This scaling or oxidation is due to excess of air in the blast, and the direct contact of the blast with iron surfaces to be welded should be avoided in order that surfaces may more readily unite, or that the best effect may be produced.

In chemistry the oil blast as used at West Oakland is an oxidizing flame. The flame within a coal fire is what is known as a reducing flame. The former tends to form oxide of iron at high temperatures; the latter, within coal fire, tends to prevent it.

As to the cost of maintaining the oil blast at welding heat; the amount of oil used was obtained by timing the oil blast (for over an hour) under constant air pressure and weighing oil tank before and after. The time so taken was used in estimating amount of compressed air used (gage pressure 80 to 100 pounds) by performance of the Norwalk compressor, used alone in maintaining the air pressure for welding. Amount of oil used for this compression as fuel under stationary boilers is based on test report of March 3.

	Gallons
Oil burned per hour by air blast.....	5.91
Oil fuel per hour to run compressor..	3.93
Total oil per hour for welding.......	9.84

Total cost for oil per hour (at 2 4-10 cents), 23.6 cents.

Yours truly,

(Signed) H. Stillman,
Engineer of Tests.

(The three welds of 1½-inch round iron by oil were made in ten minutes.)

A Flexible Metallic Joint.

The illustration shows a practical and efficient flexible metallic union of recent design, adopted to make a steam or air-tight connection where a universal motion is desired. In constructing this joint no packing is required, the cap nut *A* providing for a tight joint around the collar, and the jam nut *B* not only holding this joint snug but preventing a leak past the threads. No unions are required when pipes are to be connected, as the connection makes a union and the joints are easily separated at any time.

The material is malleable cast iron, which enables the joint to withstand a great deal of hard usage. It is the invention of J. C. Martin, Jr., of the Southern Pacific Company at San Francisco. Patents for this device are now pending.

Germany to Imitate American Locomotives.

Consul-General Frank Mason makes the following interesting report from Berlin:

"On the 13th of February there was forwarded to the department from this office an editorial article, with translation, from the *Frankische Curier,* of Nuremberg, embodying a letter which had been sent by the Bavarian State Railway administration to the two leading makers of locomotives in that kingdom, wherein it was explained that the principal purpose of the Bavarian Government in ordering a number of American locomotives for service on the state railways was to give Bavarian engineers and engine builders ample opportunity to test, study and imitate, so far as should prove desirable, the superior features of the American machines.

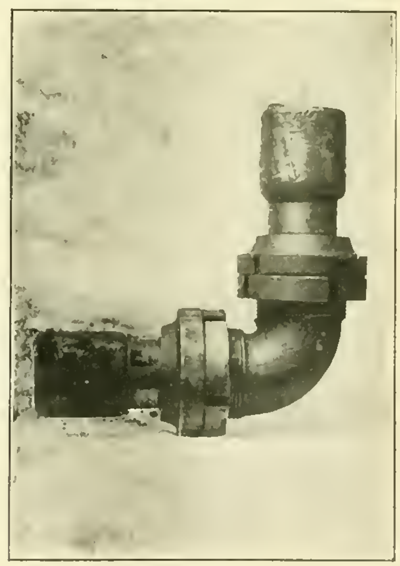
"A second chapter of this interesting episode appears in a paragraph which is herewith translated from the *Burger-Zeitung,* of Berlin, issue of March 21, 1900, as follows:

" 'The Prussian State Railway administration also intends to soon make a trial of American locomotives. These machines have shown that by reason of their great boiler space and heating surface, they are more efficient and economical. The Ministry of Public Works at Berlin has directed that specifications of locomotives of American models shall be laid before it, in order that it may ascertain, through trials of freight and passenger engines, whether the introduction of that system here is advisable. The similar tests which the Bavarian State railways have made with American freight engines have had the most satisfactory results; they have, as the minister reports, "with faultless performance, cost considerably less than locomotives of similar class belonging to the Prussian railway system." It need hardly be explained that if these engines demonstrate their superiority and are adopted, they will not be built in any foreign country.'

"The final naive reassurance to German machinists on the part of the *Burger-Zeitung* was quite unnecessary. It has been evident from the first that the American locomotives brought to Germany during the past six months were—like American stoves, machine tools, pumps, and various other machines and articles not patented in this country—intended mainly to be tested, studied and used as models to be imitated by German builders. It is a sincere and flattering compliment, and, although not directly and largely profitable to American builders, has still its value as an illustration of the importance of protecting as far as possible, by German patents, every American invention or improvement that is sold for use in this country."

A Yellow Locomotive.

Engine 235 of the Plant System, which draws the suburban train between Tampa and Port Tampa, Fla., a distance of nine miles, is a novelty as regards the color of the painted work. The color adopted some years ago by Mr. H. B. Plant, the manager of this system, for the cars, buildings, etc., is a bright yellow. This engine has the drivers, truck wheels, pilot, the cast-iron covers for cylinder heads and steam chests, sand box top and bottom, cab and tender painted the Plant color, with the Maltese cross on the end of axles


FLEXIBLE METALLIC JOINT.

on the engine. The jacket, front end and stack are left the usual color.

This engine presents a very novel appearance, especially as the cars she draws are also of the same color. While it is, doubtless, more expensive than the black generally used on locomotives, yet for a suburban train that works in and out among other trains it is a distinguishing mark which enables the passengers to locate it easily.

Lackawanna Ten-Wheelers.

Heavy trains and fast speed have compelled the management of the Delaware, Lackawanna & Western Railroad to increase the weight and capacity of their passenger motive power, and they have recently received from the Brooks Locomotive Works a group of ten-wheel passenger engines of the class shown in the annexed engraving. The engine weighs 179,000 pounds in working order, of which 137,000 pounds are on the drivers. The wheel-base is 25 feet 3 inches, 14 feet of that being rigid wheel-base or the stretch of the driving wheels. The cylinders are 20 x 28 inches, and the driving wheels are 69⅜ inches diameter. The boiler carries a working pressure of 210 pounds to the square inch. Figured by the Master Mechanics' rule, this gives the engine a tractive force of about 28,000 pounds and a ratio of traction to adhesion of about 4½.

The firebox, as will be noticed, is of the wide Colburn type, and has a grate area of 84.2 square feet and heating surface of 180 square feet. The tubes, of which there are 350, are 2 inches diameter and 13 feet 10¼ inches long, give 2,520 square feet of heating surface, making a total of 2,700 square feet.

The engine has piston valves that have steam ports 20½ x 2 inches. The exhaust ports have 75 inches of area. Throughout the engine shows evidence of very careful designing, and we are informed that they are doing excellent work.

One of the neatest devices in connection with the air brake we have seen recently is the automatic emergency recorder recently put on the market by Thornton L. Motley & Co., of New York. It's worth looking into.

Locomotives Using Oil for Fuel.

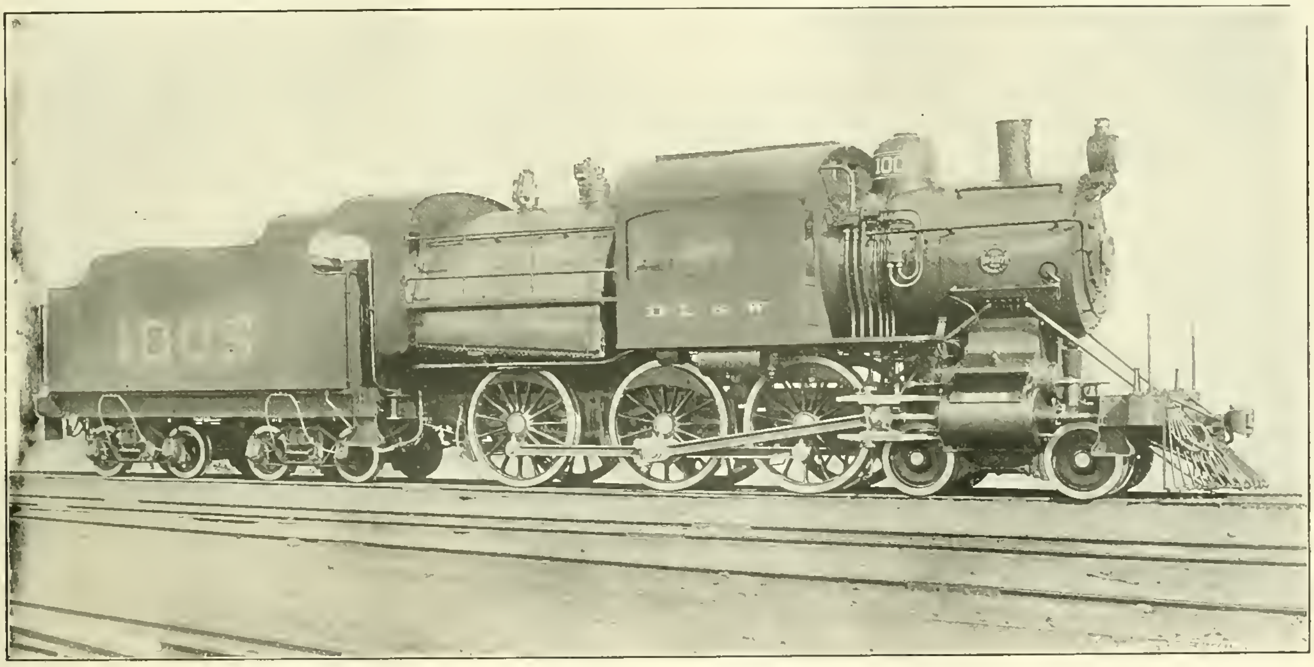
There is considerable curiosity in the East, where coal is used exclusively for fuel, about the oil burners on the Pacific Coast. A representative of LOCOMOTIVE ENGINEERING recently spent some time on these oil burners, and this article shows how a coal burner engineer looks at the operations of using oil for fuel. We will not go into the chemical questions involved in the matter of the perfect combustion of oil fuel, but treat of the mechanical side of it and the apparatus used.

Oil has been used for fuel for a good many years on the Pacific Coast. The large ferry boat Solano used it previous to 1884, but went back to coal.

On the Southern California Railroad—which is now a part of the Santa Fe route—Master Mechanic G. W. Prescott began burning oil in 1894, and they have used it more or less ever since. Various minor changes have been made with a view to improve the process; but in the main the arrangement has been about the same for the last three or four years; about all their engines burn oil now. The Southern Pacific Company also burn oil. Since the discoveries of oil near Bakersfield they are changing their engines from coal into oil rapidly, putting up supply tanks wherever needed, and it looks as if the use of coal there would fall off considerably. On the Southern California part of the Santa Fe route, to change from coal to oil fuel the grates are taken out and a cast-iron plate is placed 4 to 6 inches below the mud ring, extending over the entire space under the firebox. This plate has three openings for air to come up into the firebox, 9 x 15 inches, one of these air openings being in the middle of the firebox, one near the front end and one near the back end. This plate is protected from the heat of the fire above by a covering of fire brick. The ash pan and dampers are left the same as a coal burner. The sides of the firebox are also protected from the direct force of the intense heat by a fire-brick wall about 5 inches thick, which comes up to the flues in front, up above the flare of the firebox on the sides and to the bottom of the door at the back. There is a brick arch extending across the firebox from side to side, reaching back pretty well towards the door, just the same as in a soft coal burner. Some of the engines also have a narrow arch just under the door, which serves to keep the intense heat from the door ring.

The side walls of brick in the box do not last very long, some of them not over three weeks. They can be patched by putting in new brick when holes are found in the old ones. Generally a whole new wall is put in at a time. With the oil burners the crown sheet lasts about as long as with coal, but the side sheets, even with the protection of the brick walls, give out at the flare of the box, near the door and at the top of the brick walls on the sides. The staybolts behind the brick walls leak some, but it does not seem to affect the steaming; the water runs down the sheet into the pan if it is not all evaporated at once. When the flues of an oil burner begin to leak badly they soon stop up, and she dies in short order. In this they are different from coal burners.

The atomizer which separates the oil into a fine spray and blows it into the firebox is located just under the mud ring, pointing a little upward, so the stream of oil spray and steam would strike the opposite wall of the box a few inches above the bottom, if it was to fly clear across the box. Deep fireboxes have the atomizer at the back end of the box, while



BROOKS TEN-WHEELER FOR LACKAWANNA RAILROAD.

the shallow and long fireboxes have it located at the front end, pointed back. The shallow boxes have the same arrangement of side walls that the deep ones have, but the arch is put in differently; some of them have three small arches extending from side to side, but lapping over each other from front to back, so as to divide the current of flame and heat into several parts and thus distribute it over the long, shallow box more evenly. A good deal depends on the size and position of the arch, which has the same effect on the steaming of an oil burner that the diaphragm in the front end has on the draft of a coal burner. No air is admitted above the fire of the atomized oil.

The atomizers (one for each engine is used) are of brass, 12 inches long, 4½ inches wide from side to side and 2 inches thick from top to bottom, divided into two parts by a partition in the middle. Steam comes into the bottom part, heats the atomizer and issues through a slit 1-32 by 4 inches. The oil flows into the top part of the atomizer over the hot partition, and on running out of the front end is caught by the steam issuing from the slit in the bottom part, and is sprayed into the fire, which, when the engine is working, is a mass of flame, filling the firebox under the arch, and most of the time the whole box. If the supply of oil fed in is more than can be consumed in the box you will occasionally see little flashes of flame at the top of the stack.

The supply of steam and oil to the atomizer is regulated by the fireman from the cab, the handles for the steam and oil supply valves being placed where he can have his hands on them when on his seat box. He is located where he can see the gage clearly, and as he sometimes pumps the engine with the left-hand injector, it has to be handy also.

Before the oil is fed into the atomizer it passes through a small heater made of brass, having a steam pipe through it; this same steam pipe also leads to a coil in the bottom of oil tank to warm the oil so it will flow easily. The oil on the Pacific Coast is not at all like the fuel oil we get from Indiana or the Lima field. Some of it has a generous portion of thick stuff like asphaltum in it, so it does not flow very easily; while other kinds are thin as water, and almost as clear.

The oil tank is located in the pit of the water tank, where we usually carry coal. In the tenders built especially for oil burners the oil tank is surrounded by the water. An air pipe leads from the main reservoir to the oil tank, with a reducing valve similar to the one used in the air signal line, but with a different spring box, so as to reduce the very high main reservoir pressures carried on the mountain engines down to 4 pounds, which is maintained in the oil tank, so the oil comes out freely. Self-closing valves are provided to shut off the flow of oil in case the engine breaks loose from the tender, as in case of accident the oil flowing into the wreck would make a bad matter worse. The exhaust tip is about the same size as the engine would have if she was burning good coal. Some of the engines have no changes made in the front end except to take out the netting; others have a low nozzle and petticoat pipe put in instead of high nozzle and a diaphragm or apron. I was somewhat surprised at this, as it would seem that more air could be drawn into the box through three openings 9 x 15 inches in size than could come through a coal fire. Another surprise was the fact that oil burners make considerable smoke, although it was stated by some of the enginemen that if properly handled they would make no smoke; others said it was no harm if they made a little smoke at times. The oil makes a sort of sticky deposit in the flues, which soon coats them and interferes with the steaming. To cure this difficulty, the fireman sticks a long tunnel through a hole in the firebox door made for that purpose, and gives the flues a dose of about four quarts of sand, which is drawn through the flues and scours them out. When this sand goes through a black cloud comes out of the stack as thick as from any soft coal burner.

DELAWARE WATER GAP, ON LACKAWANNA RAILROAD.

If this oil could be vaporized by heat as easily as it is atomized by steam, that is, changed into a gas instead of a spray, like gasoline is burned, it might be made smokeless; but the oil has a heavy residuum in it that cannot be vaporized very well. Then, the changing conditions under which the engine is worked interfere with perfect combustion. At one time, when working hard, a large stream of oil flows into the atomizer; when switching or running shut off a very little is used; so the fireman has to open and close the oil supply valve with every change in the work of the engine. As there is no bed of live coal to hold back the air, just enough oil must be admitted and burned to heat all the air drawn in by the exhaust, for if this air struck the flues cold, as it would be sure to do if too small a supply of oil was burning, the cold air would soon set the flues leaking.

When these oil burners are in good order and properly handled it is astonishing how they will steam. When working on a hill with a full train and a steady pull for 21 miles, a ten-wheel Baldwin with 21 x 28-inch cylinders and 56-inch drivers would pick right up with both injectors on full, and these injectors large enough so one of them would ordinarily supply her. Of course, if not properly handled, oil burners will lag on their steam, but ordinarily they steam "like a house afire," as one of the firemen expressed it.

Do not think that firing one of them is

a soft snap because there is no coal to handle. The fireman has to stay right on his box, and with his hand on the handle of the oil supply valve, which is like the handle of F-6 brake valve, with very fine notches in the quadrant or ledge, he watches the gage and the engineer and regulates the supply of oil to suit the work. When running shut off or switching at stations, it is a close matter to allow enough oil to go to the atomizer to keep the fire alive and not have too much.

There is a good deal of water in the oil, and they are so near the same specific gravity that the water comes through with the oil. When a charge of water comes through the fire goes out for an instant, but lights up again when the oil comes again. The end of the supply pipe for the oil is located a little way above the bottom of the oil tank, so as to draw oil only, but the water comes in also. There is a drain pipe in the bottom of the oil tank, which can be opened at any time to drain off the water.

Several forms of atomizers are used, but most of them follow a general principle. On the Southern Pacific Master Mechanic Sheedy uses one that was illustrated on page 151 of the April issue of LOCOMOTIVE ENGINEERING. This form has an air draft in with the oil, which helps the work of the atomizer. On a stationary engine it is smokeless. The one used on the Santa Fe has no air openings in it.

As to the relative expense of oil and coal for fuel, coal is so high priced there that oil does the work cheaper. Good coal at Los Angeles and San Bernardino costs $6.50 to $7.50; oil costs about $2 a ton less. Where they burn good coal it takes a little more than a ton of coal to equal a ton of oil, but at Barstow and east of there, where the coal is poor, it takes nearly two tons of coal to equal one ton of oil. The engines do not steam as freely with the coal, so they cannot make as good time or handle a large train at as high a rate of speed. Time in transit is of some account and is worth money.

In the East, the country of cheap coal and dear oil, we will not be apt to see any oil burners for some time, except for special purposes. If some of the poor steamers that handle heavy passenger trains were turned into oil burners it would enable the engines to do better work, for there is apparently no limit to the steaming power of an oil burner.

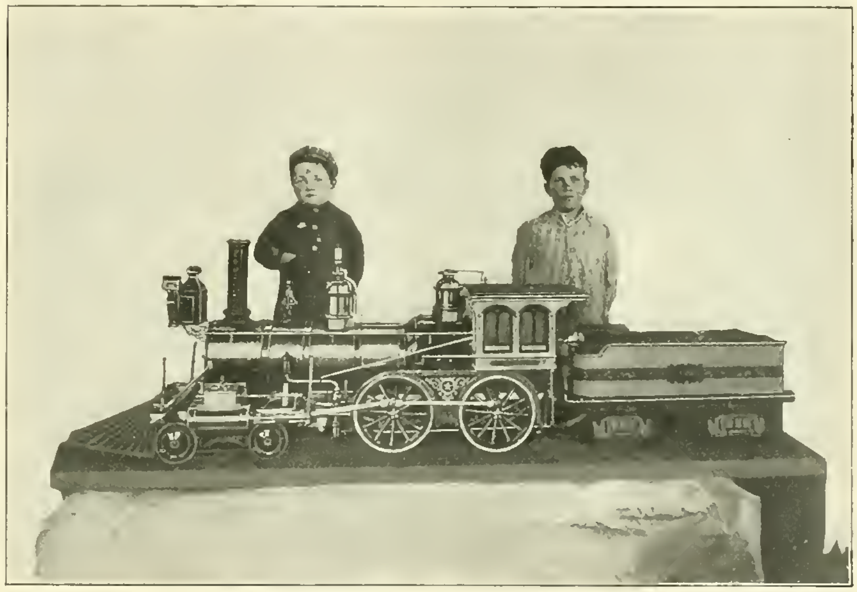
At terminals there is no waiting to clean fires, arches or flues before the engine can go back. If the machinery is all right, they take oil and water at the same time, and the engine is ready to go out, which is a saving when short of power. The oil is fed into the tender from elevated tanks just the same as we take water, and as quickly. Storage tanks are located along the road where needed, the same as coal chutes. At San Bernardino the Santa Fe have a large main storage tank 96 feet in diameter and 30 feet high, which holds one and one-half million gallons. All the oil at this point is elevated and handled with compressed air with no waste.

The tanks along the road are much smaller affairs, like small water tanks.

The discovery of the extensive oil fields at Bakersfield has added such a large amount to the visible supply that there is no risk of its giving out very soon, and the engines between Kern City and Los Angeles on the Southern Pacific are to be turned into oil burners. The changes are now being made.

Engineering on a Small Scale.

One of our friends in Springfield, Mo., Mr. James Robertson, sends us the photograph of the small engine and crew. The engine is named "A. H. Handlan," the engineer is Master Walter Hardy, who stands behind the tender, while the chubby fireman is Master Floyd Robertson.



Floyd Robertson, Fireman. Walter Hardy, Engineer.
A SMALL ENGINE AND CREW FROM SPRINGFIELD, MO.

The engine is modeled after one of Rogers' build, and the main dimensions are as follows: Gage, 11 inches; cylinders, 2½ x 4 inches; size of drivers, 9 inches; size of truck wheels, 3¾ inches; driving wheel base, 13 inches; total wheel base, 37 inches; length of engine with pilot, 60 inches; weight of engine, 300 pounds; weight of tender, 90 pounds; height from top of rail to top of stack, 25 inches; diameter of boiler, 7 inches; length of firebox, 6 inches; width of firebox, 4 inches; grates, rocking; tubes, 150, size ¼ inch; length of tubes, 14 inches. It is equipped with sight feed lubricators, safety valve, injectors, steam gage, Handlan patent headlight. The tender is 25 inches long, the underframing is of iron; coal capacity, 50 pounds; water capacity, 4 gallons.

Air Tools in Boiler Shops.

At the Albuquerque shops of the Santa Fé route, Mr. Alfred Parfitt, foreman of the boiler shop, has a great many ingenious devices for the use of compressed air to expedite the work of getting out staybolts, crowbar bolts and rivets, etc. Among them is a hydraulic punch or jack, which is operated by air pressure. It is portable, so it can be moved around easily, and will punch rivet holes as fast as it can be moved from one to another. It comes especially handy in work that has been flanged, like throat sheets, door rings, etc.

A large air cylinder operates a smaller piston, which forces water at a very high pressure to the hydraulic punch, a connection being made with a ¼-inch copper pipe, which can be bent to allow the punch to be moved from one hole to another. The jack is operated in the same manner. It can be set under any part of the boiler, and raise it up where it can be blocked up.

Both these devices are patented. We understand the Q. & C. Company are about to manufacture these devices and put them on sale.

A Portable Saw Table.

At El Paso, Texas, General Foreman Booth has coupled an air motor to the shaft of a small circular saw, which comes very handy for the car repairers when making repairs on woodwork. As there is a steady pressure of air in the yard, it is ready for use at any time by opening the air valve. When not in use there is no expense for belts and countershaft. This table, saw, motor and all can be moved around to any convenient place in the yard, and the air hose coupled up; it is then ready for business on a minute's notice.

General Correspondence.

All letters in this department must have name of author attached.

A New Zealand Engine.

As I have only once seen a picture of a New Zealand engine in your paper, and as I like to see this part of the world represented, I enclose a photo of a train crew at Mangaonoho, some 140 miles from Wellington.

The engine is class "F," cylinders 10½ x 18 inches, six-coupled wheels 36 inches in diameter, heating surface 485 square feet, and weighs 19½ tons in working order. The one represented carries a pressure of 160 pounds per square inch. These engines are very good steamers and pull a good load. The person on left is F. Sargeant, next to him D. Hood, spare driver. The cleaner is the center figure, and standing next to him is A. Morse, guard. The one on the extreme right is T. Campbell, driver in charge.

A. P. Godber.

Petane, New Zealand.

A NEW ZEALAND LOCOMOTIVE.

Novel Method of Protecting a Patch Seam in Firebox.

Will you kindly give me your advice on the practicability of protecting the seam on a patch in firebox of a locomotive as described below? I have never had any experience in a case of this kind, and, knowing that your readers have had all kinds of experience, I thought perhaps you could enlighten me on the subject.

I propose to put in a 2 or 3-inch tube extending from front to back sheet of firebox, close to and in front of a patch seam which extends full length of box and about 18 inches above grate bars. We burn bituminous coal, and the patch soon fire-checks from patch bolts to edge of seam, causing leaks. My idea is that the intense heat of the fire would not come in direct contact with the seam on account of this tube, and the tube would not burn out, as water would circulate through it. I think it is customary to put up castings sometimes to protect patch seams, which soon burn out, hence my desire to put in the water tube as a protection.

I will casually say that I have been a constant reader of your magazine since its first issue, and have obtained valuable information from its pages. Hoping you will give me the desired information,

W. M. Morse,

Supt. and M. M., Toledo & Ohio Central.

Marietta, Ohio.

[This is a decidedly novel way of protecting a patch seam, which generally gives trouble from the edge exposed to the direct action of the fire burning out. The only weak point we can think of about the plan is that the protecting tube might be damaged by lumps of coal thrown against it. We should like to receive the opinions of our readers about it.—Ed.]

Getting Off the Center.

When you consider what a vast amount of time has been lost by engines breaking down on one side and then getting stuck on the dead center, it is wonderful that some device has not been fixed permanently on the engine to help it off the center, in cases where they are running on one side.

Of course if you talk to the average engineer about it, he will tell you what he did when he broke down and ran in on one side—he pulled the whole train and only lost a little time. I have done the same thing. And there were times when I could not help myself; I had to have an engine come and help me. Take a case of an engine running on one side in the night-time, when it is hard to trace your crank or crosshead. To stop on the quarter is a difficult thing; then again you stop at a water tank; the tank must be just right for the spout, and perhaps this brings you right on a dead center; then you are in trouble.

I have been thinking for a long time to get up something to help the man to run on one side, or to get him off the center. Of course, there are a number of devices that could be arranged to do this, but they would be expensive, and on that account would not be adopted.

I have discovered a novel way to get an engine off the center, that has a push-out driver brake located on rear end of the frame in the rear of the back driving wheel.

The plan for starting is this: If you have a train, let out the adjustment on driver brakes; cut out tender brake; have a trainman cut out the train line with angle cock at head end of head car or rear of tender, and stand right there to cut in again as soon as train is started. Let your tender brake run cut out, as you will have enough brake power without it; take your coal boards or any other strong stick long enough to reach from your brake cylinder piston to the spoke in the rear driving wheel, as far up, of course, as possible to get the leverage. Let your train line pressure come up to the reservoir pressure, 90 pounds, then apply your brake; and before your brake shoes are pulled up to the driving wheels, with a push-stick on both sides and 10-inch brake cylinder, you get a pressure of 10,995.6 exerted against a wheel with a leverage of anywhere from 12 to 24 inches, which will start any engine on a level track, even if the slack is taken up on train. The wheel will only have to move off the center line, then she will commence to help herself. Your brake is immediately released; the trainman opens the angle cock and picks up the push-stick on the one side; the fireman picks up push-stick on the other, and away you go rejoicing.

This method has been tried by the writer and found to work all right without letting out the adjustment on the driver brakes; but he puts this proviso in so, in case the slack was taken up just previous to the break-down. The only expense that is necessary to use this plan is, to have a stud set in the counter-balance of the rear driving wheel on both sides. ARTHUR J. O'HARA.

Port Jervis, N. Y.

More About Firing Big Engines.

There has been of late years a sort of a conflict of opinion regarding the one-scoop firing as applied to consolidated engines, and the writer has kept a pretty close lookout for the different articles and, at the same time, has been trying to put the different teachings, or a part of them, at least, to a test.

The engines around this vicinity are of a very large type, and are hauling from 2,500 to 2,700 tons. Now, in order to furnish the required amount of steam at all times, it is quite necessary to shovel a great deal of coal; the result of which is hard, actual labor, and there are few, regardless of the engineer, who are able to realize the feeling of one after making what is known as a hard trip, unless they have taken the same step on the same size deck.

While physical strength is one of the chief requirements, there is yet another, and that is, a clear and certain mind applied to the action of the fire at all times; and the sooner this is carried out, the sooner will we be able to appreciate the advantage, not only to the company by which we are employed, but to ourselves. A constant watch of the fire means a saving of coal, and every pound of coal saved takes so much exertion from the fireman.

But it hardly cuts much of a figure how careful one may be in watching the fire, if the one on the right side does not use judgment in the adjustment of the reverse lever and throttle and if the water is not fed to the boiler at the right time and at the right place. It is quite safe to depend upon the engineer as a helping hand, however—at least I have found it so during my brief experience.

When we are fortunate enough to be called to go out on a good steaming engine, one can experiment a great deal as to the easiest method of firing. The writer has tried the four, three, two and one-scoop method, and has obtained the best results by the use of the one-scoop racket.

A level fire is the most essential point in the firing of an engine, and this can be accomplished much easier by applying one scoop at a time. So long as one keeps his fire at the same thickness, the action of the exhaust is then of great assistance, for its effect is about even on the whole surface; but as soon as a heavy place is scooped in the firebox, the exhaust only tends to cause an uneven fire; for it is more effective on the thin part, and if this thin place is not soon filled up to the same thickness as the rest, we will soon find a hole in the fire which results in the use of the hook.

I do not believe that four or five scoops of coal can be scattered into a firebox without putting green coal on top of green coal, which is detrimental to a fire. It is not a good plan to cover the whole surface of a fire, for it tends to reduce its temperature. This fact can be brought to view by waiting until a bright fire has been built and then putting in four or five scoops. In a few seconds open the door, and notice the change in the color of the fire. We will find a red blaze; combustion has not been perfect and part of the gases without flame are drawn through the flues to the stack in the form of smoke. Take the same fire and add one scoop in the proper place, and then watch for the change in the color of the fire. We will find about the same temperature; the one scoop of coal has not changed the temperature either way, but it has kept it up to the same heat.

We often find a fire burning so brightly that it is impossible for anyone to see any part of the surface, and continuing the same way for miles. Now, in order to keep the fire in the same condition, it is necessary to keep in mind where the last scoop of coal was placed, and when the next scoop is applied, try and separate them as much as possible. Keep in mind at all times where the last coal was placed, and so on. So long as the fire remains in this condition, we may rest assured that the coal which has been shoveled in is creating the greatest flame and that all the heat is consumed in the firebox, and that none of the gases have been drawn through the flues to the stack in the form of smoke.

It is surprising to learn how far one scoop of coal will run a fellow after a bright, level fire has been built; and one may ask, how often shall he attend to the fire. Practice will teach this, the same as it taught us when to put in four scoops. If the fire becomes too thin after firing four or five miles with one scoop, we have been waiting too long between intervals, and should be governed accordingly.

Sometimes when a fire has been built up to the highest heat, the engine can be fired by watching the steam gage. You will often find the pointer communicating so closely with the firebox that it will respond to each and every scoop of coal. The moment the pointer commences to drop back—say, 1 pound—put one scoop of coal in where it belongs and watch the pointer creep up. This can be kept up and the fire kept up to the same thickness without any exertion.

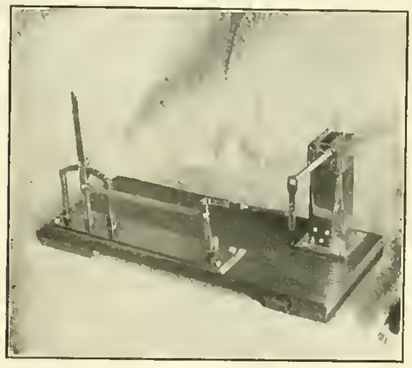
We often find the engineer carrying the water at such a height that will permit him to adjust the water valve to prevent the engine popping, and is changed again to a point where it will supply the boiler. When this is done, the engine is being fired with use of the least possible amount of coal, and is being fired for all she is worth.

In order to carry a bright and level fire, it is necessary to learn how and where she is burning her coal, which can only be accomplished by close observation—the only rule by which a locomotive can be fired successfully.

W. A. REESE,
P. & L. E. R. R. Co.

Variable Nozzle.

We notice in April LOCOMOTIVE ENGINEERING an editorial on variable nozzles. We take pleasure in forwarding to you photographs of the model of our improved motion, taken in three positions (one used). You will notice the variation can be changed from center to extreme travel by the adjustment of connecting rod to bell crank outside of smokebox. The straps that are connected to the moveable wings are slotted, and tap bolts extend through them into wings. When a larger



WALLACE & KELLOGG VARIABLE NOZZLES.

or smaller opening is desired when reverse lever is near center, these tap bolts can be loosened and wings moved in or out as desired.

This form of expanding nozzle is on trial on Burlington, Cedar Rapids & Northern and Duluth & Iron Range Railroads.

WALLACE & KELLOGG.

St. Paul, Minn.

Adapting Engine to Train.

Uncle Billy had been having a little vacation, and I expected to find him cheerful and happy as a lark, as is his custom, but here he was fuming around as if everything had gone wrong.

"What's the matter, Uncle Billy?" said I. "New rules and regulations about oil? Have to count the drops now instead of measuring?"

"Now, Robert, 'tain't that, nor nuthin' 'bout oil. I'm just running railroads in my mind, and when I think of some of the things I've seen it just makes me hot to think of me here squirting oil and some other chap drawin' a big salary for managin' a road. Managin' nothing. Why, some of the boys that I've kicked off the old 13 as being no use to me or theirselves wouldn't do what I've seen.

"No, don't stop me till I've had my little spout; then you can hold forth—after I'm tuckered out. First thing I struck was one of the fast trains on the Beautiful & Ancient line, and they did make things hum. But when I saw that they had been using a big ten-wheeler to pull three cars over a dead level road I couldn't believe my eyes. Thinks I 'she isn't so big as she looks,' and I asked the engineer about her. 'She's 21 x 26,' says he; '190 pounds of steam, and she's a daisy for going.' Couldn't believe my ears, Rob—really couldn't. Bragging about a 21 x 26 doing what a 16 x 22 could do any day. But I don't blame him so much as the fellow who bosses things and lets him do it.

"I found several places like this—great big engines, fine engines, too, and wasting their time doing half the work they ought to; made me feel just as I do when I see a great, strong fellow blacking boots—that's a boy's job.

"Then I found another kind of an overgrown engine. 'Twas a road with a few hills—one bad one, too. Well, here they had a great big ten-wheel engine, heavy enough for a freight train, pulling a six to seven-car train. The engine was all right up the heavy grade, but as for running it 130 miles over a level track for the sake of one hill—well, p'r'aps I'm getting out of date anyhow. If 'twas me, I'd put on an engine that would haul that train over the greater part of the road, and do it easy. Then I'd put on a helper at the hill. Wouldn't cost so much to run, would be easier on track, and—— Did you say one quart of cylinder oil and two of engine, or what"——

And I skipped to see what engine I had been assigned to. Seems to me Uncle Billy wasn't so far out on some things, if he is an old-timer. R. E. MARKS.

Camden, N. J.

What Makes the Locomotive Go?

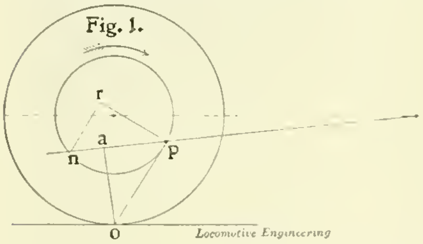
The subject of what makes the locomotive go seems to command considerable interest, as it should, and I think a few more thoughts along this line would be appreciated. Our mathematicians and professors of mechanics have neglected the peculiar problems of the locomotive, and there is a notable lack of scientific investigation in the realm of locomotive engineering. Exhaustive mathematical works may be found upon nearly every important mechanical contrivance except the locomotive. It is true that because of the wide range of conditions the locomotive is required to fulfill, it is less amenable to scientific treatment than many other devices, and this may account for the lack of this kind of literature. In the beginning a careful distinction should be made between what makes the locomotive go forward or backward, and what makes the drivers go around. That this distinction is necessary is evident from the fact that the pressure of the steam on the cylinder heads must be taken into account in considering the motion of translation along the track; but these forces have no effect upon the rotation of the driver about its axis. This is what vitiates all comparisons between the locomotive and stationary engines concerning the motion along the track. The problem is one of parallel forces in a plane of which the lever is a particular case. It was stated in LOCOMOTIVE ENGINEERING of September issue that it is only the horizontal forces with which we are concerned. This is true with the pin on either quarter, but does not hold good for other positions. A more exact statement would have been, that we are concerned only with the forces in the direction of the constrained motion under consideration.

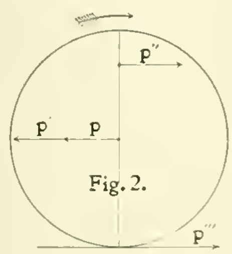
In the paper referred to, it was shown that the driver is rotating about the point in its circumference in contact with the rail when the pin is on either quarter. This is of course true for any other position of the pin. This granted, Fig. 1 will show us the component of the force along the main rod which we wish to find. Let the pin be at p; now at the instant the driver moves it will be rotating about the point o, and it is the force in the direction $p\,r$ at right angles to $p\,o$ which becomes effective. Let the force along the rod be $p\,n$ to some scale, then by resolving $p\,n$ into its two components $p\,r$ and $r\,n$ we obtain the amount of $p\,r$. It is a convenient way of comparing forces tending to produce rotation to take the product of each force into its arm. Draw $a\,o$ perpendicular to $p\,n$. Now from the similar triangles $p\,r\,n$ and $p\,a\,o$, $p\,r : a\,o :: p\,n : p\,o$, or $p\,r \,.\, p\,o = p\,n \,.\, a\,o$; thus proving the equality between the whole force along the rod into its arm and the effective force $p\,r$ into its arm. The train resistance and adhesive force are parallel to the track and acting in a line perpendicular to it, and it is evident that for our purpose we may replace the force along the rod by an equal force acting in this line parallel to the track and at a distance $a\,o$ above it, as determined in Fig. 1. Thus the problem becomes one of parallel forces and their moments about the point on the track found as indicated in Figs. 2 and 3. Let p = train resistance, p' = pressure on the cylinder heads, p'' = force along main rod, and p''' = adhesive force, which need not be considered, provided the driver does not slip. These are all the forces acting on the driver statically. After what has been said, I believe Figs. 2 and 3 to be more readily understood than the one given in LOCOMOTIVE ENGINEERING, April issue, by Mr. Wilcox. Let us assume his values in Fig. 3, and we have: $2\,p' = 1.p'' + 2.p$, or $p = \frac{2.p' - 1.p''}{2} = \frac{2{,}400 - 12{,}000}{2} = 6.000$ pounds. In Fig. 2, $3.p'' = 2.p' + 2.p$, or $p = \frac{3.p'' - 2.p'}{2} = \frac{36{,}000 - 24{,}000}{2} = 60{,}000$ pounds.

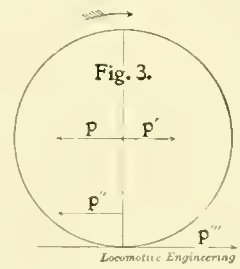
Several interesting facts are to be noted from the figures given. When the pin is on either center p' and p'' become equal opposite forces acting in the same line, and have no tendency to produce rotation. From Fig. 1, when the main rod produced intersects the rail at the point of contact with the driver p'' disappears and we have the same effect as would be produced by disconnecting the main rod at this point and bracing it against a convenient telegraph pole or bridge timber. The piston becomes stationary in reference to the ground at this point, and not at the dead centers, as was stated in September LOCOMOTIVE ENGINEERING. Should the main rod produced intersect the rail at a point forward of that in contact with the driver on the back stroke, the force p'' into its arm becomes a moment tending to roll the driver forward. No more useful effort would be gained by this condition, however, for the piston is traveling backward in space while the cylinder head is traveling forward, and the pressure in the cylinder is falling at rate which exactly compensates for the more advantageous application of p''. These last two conditions do not occur, however, as locomotives are ordinarily constructed. Much remains to be said on the subject, and I had intended to add a word about fulcrums, but will drop that for brevity's sake.

ADELBERT DRYER.

Washington, D. C.







Large Wheels and High Speed.

Most people think that an engine's speed depends on the size of her drivers, and too many engineers even have the same idea.

That speed is for the most part a question of power rather than wheel is shown by the enclosed clipping, which is rather interestingly written. It is from a Philadelphia daily paper:

"The Chicago, Burlington & Quincy Railroad has a pair of big twin engines, 1591 and 1592. They are only a little over a year old and weigh 127 tons apiece. They have great wheels, 84¼ inches in diameter, and compound cylinders, extra large. As a matter of fact, they are the biggest passenger engines ever built, and as to fast running, they have been the 'whole thing.'

"Now, what do you suppose happened?

"A mogul, class H-2, No. 1091, fairly well born, to be sure, but comparatively a lightweight, but with very little brass work about her, used principally in the freight service and considered an excellent steady old girl, was the other day in a case of emergency hooked on to the fast mail No. 8 at Burlington, and came sailing into Chicago, 205 8-10 miles, in exactly 205 minutes—after stopping on the way seven times to take a drink. At Mendota she stopped six minutes, and the story goes that something a little stronger than water was given her there, because on leaving the town she felt so gay that Aurora, 45 4-10 miles away, was reached in just forty minutes. A rate of 68 1-10 miles an hour for a mogul! Engineer Gillette and Conductor Cullenbine say that it was all done on the square, and that she had nothing to drink at Mendota but pure water.

"Well, at any rate, the twins are furious, and they are puffing and blowing about what they will do the next time they are turned loose. They never liked the mogul, and say she is a fast old thing. Probably after this they won't whistle as she passes by."

Most railroad men can give similar instances, and it may help show up the fallacy of the idea that "if we only had bigger wheels we could get there."

Don't understand me as advocating small wheels for high-speed work, for I believe in the big driver on fast trains—but it takes more than drivers to make 75 miles an hour with a fair train.

Honeybrook, Pa. I. B. RICH.

Arches and Leaky Flues.

The inquiry of M. D. Corbus in the January number in regard to arches and leaking flues I hoped would bring out some opinions from the men who put in arches and caulk the flues; but so far the correspondents have been mostly engineers. I have been "flue tapper" in a roundhouse for several years; have put in a great many different kinds of arches in different makes of engines, and have never known a case where an engine carrying an arch did not need more work than one without in the same class of service. Of course, in passenger and time freight engines, which have sufficient lay-over to become cooled off slowly, the difference is not so marked as on the engines running in pool. Still, in these the bottom flues wear out faster and flue and side sheets crack worse than in engines in the same service running without an arch. In the pooled engines the difference in labor to keep engines up is at least 20 per cent greater than in those without arches. The reason is, I think, the intense heat under the arch; the heat cannot rise there as it does in other parts of the firebox, but must rush through the small space between arch and flue sheet, carrying with it smoke and cinders, filling up the bottom flues. When the engine comes in these flues cannot be cleaned out, and the beads burn so that they fall off when caulked. Brace rivets and staybolts in flue sheet get their share of this, and leak also. Again, when the engine is washed out the arch holds heat too long. I have gone into fireboxes when boiler had been washed out and filled with cold water, and the arch would be still red hot. This must cause unequal contraction of the side sheets. But the worst feature of the arch is that it is impossible to do the necessary work when it should be done. There is hardly any class of work where the adage "A stitch in time," etc., is so applicable as in locomotive boiler work. An engine comes in with some flues leaking; a few minutes' work may be all that is necessary to caulk them so that another trip can be made; if neglected the water running down the sheet mixes with soot and cinders, forming a clinker, clogging other flues and causing them to leak; engine does not steam, and failure results. A brace rivet starts; a few blows of the hammer will fix it; if let go the jet of steam may cut a hole in flange of flue sheet, making a bad place to plug or fix in any way. Of course, the foreman says always do a good job and never let an engine go out unless in good condition; but just the same, when engines are ordered out before they arrive at terminal, and foreman, engineer, fireman, and sometimes master mechanic, are watching and hurrying everyone to get an engine out on time, any man will look at that wall of red-hot brick twice, at least, before he knocks it down. Brick arches, no doubt, have good points; but where poor coal is used and feed water is impregnated with lime, they injure both flues and side sheets.

T. W. LAW.

Performance of Engine on the Central New England.

I send you under separate cover monthly performance sheets for this road, reaching from February, 1899, up to March, 1900.

Engine 4 is the engine you mentioned on page 189 of May issue, and you will note that she made the following mileage: February, 3,194; March, 4,789; April, 4,311; May, 4,960; June, 5,035; July, 4,998; August, 5,067; September, 3,740; October, 4,590; November, 4,839; December, 4,917; January, 4,161. Total, 54,601.

At the end of January and the beginning of February, 1900, we put into this engine the Master Mechanics', or as it is sometimes called, the Norfolk & Western front-end arrangement; that is, the low exhaust pipe and two petticoat pipes between the exhaust pipe and stack. Since then the engine has made the following mileage: February, 3,680; March, 4,875; April, 4,500. Total, 13,055. This makes a grand total of 67,656 miles, and during all this time we have not renewed the packing rings in either pistons or valves in this engine, which I think is due to the increased number of relief valves, but mostly due to the split air-pump exhaust.

I am not running a nozzle smaller than 5 inches on these Master Mechanics' front ends for anything over 18-inch cylinders, while the 18-inch engines are running with a 4½-inch single nozzle, and are remarkably free steamers.

Engine 4, of which I gave you the mileage, is a compound engine, with 5-feet 9-inch drivers outside of tire, 12 and 20 by 24-inch Baldwin compound cylinders.

HUGO SCHAEFFER, M. M.

Hartford, Conn.

Ingenious Perpetual Motion Machine.

"In the fall of '95," said the superintendent of a New Orleans machine shop, "I was requested by a friend to examine an alleged perpetual-motion apparatus constructed by a German mechanic in the old quarter. I told him it was a waste of time, but he insisted. 'Theories are all very well,' he said, 'but this thing actually goes, and I want you to see it.' I went to the house and looked at the model, which was certainly singular in appearance. It resembled a miniature seesaw, mounted on a small wooden base, with a magnet set in the side. A metal ball placed at one end of the machine was drawn up, apparently by the magnet, fell through a hole, ran back to the starting point, and was drawn up again, repeating the operation indefinitely, and imparting an oscillating motion to the see-saw. All this seemed extremely simple, and there were evidently no concealed attachments, as the machine could be easily lifted up and examined. It wouldn't work anywhere except on the table, but the inventor explained the fact by saying that the legs had been carefully adjusted with a spirit-level, so as to get an exact balance. I knew there was fraud somewhere, and laying my ear to the table top, was rewarded by a faint buzz of machinery. At that the German became furious, declared his honesty was impugned, and ordered me out. Later I learned the secret. Concealed in the table was a strong electro magnet mounted on the edge of a revolving wheel. In that way the magnet passed and repassed directly beneath the end of the perpetual-motion machine, dragging down the see-saw. As I remarked before, it was beautifully simple. My friend didn't invest."

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Timber for Ties Becoming Exhausted.

Several of the big Western and Southwestern railroads, it is said, are consulting with the United States Government's Department of Forestry with regard to the growing of timber on their non-utilized rights of way. Among them are the Chicago, Milwaukee & St. Paul and the Atchison, Topeka & Santa Fé, and the governing officials of these systems realize that the supply of timber for the making of ties, poles and posts is becoming less each year. One of the questions that is perplexing and bothering the officers most is, Where shall we get our ties, poles and posts fifteen or twenty years from now?

The Department of Forestry is said to have taken a deep interest in the question of growing timber on non-utilized rights of way, and it has expressed its willingness to give the railroads the benefit of its knowledge of tree-planting. Ties are more costly to the roads now than they ever before have been and indications point to increase in prices annually. The carriers in the North and Central West are obliged to pay the highest prices for roadbed timber. Mr. John Findley Wallace, assistant second vice-president of the Illinois Central, recently said that the average price per tie to the roads in Northern Illinois was about 75 cents. This estimate was based upon the cost of transportation and all other conditions necessary to the delivery of the tie to the side of the track where it is placed.

White oak is the most desirable material for ties. This wood is grown in the middle South and the means of delivering it to the roads are quite difficult. In the marsh lands of the far South cypress is used the most. The average period of usefulness of a first-class white-oak tie is ten years, and Mr. Wallace esimated that about 300 ties annually were required to keep each mile of track in the United States, Mexico and Canada in proper condition. There are about 300,000 miles of track in the three countries, and according to Mr. Wallace's way of figuring, 60,000,000 ties are required yearly to keep up repairs. Between 30,000,000 and 40,000,000 ties are used every twelvemonth in the construction of new tracks.

The renewal of ties is the most important item of expense in the maintenance of way. In the year beginning in June, 1897, the Illinois Central used 1,603,632 ties in repairing its tracks. The amount charged to the renewals was $535,778.16. From 1888 to the middle of last year that road spent about $4,250,000 for the renewal of ties.

Numerous kinds of inferior wood, such as hemlock and red oak, are being scientifically experimented upon by many of the roads. They are being subjected to chemical treatments that are said to lengthen the serviceableness of the wood.

In touching upon the subject of ties and the future provision of ties, Mr. Wallace had this to say:

"Ties are becoming more costly as the time goes by and the securing of them is a very important thing to the roads. The great march of civilization and progress will not allow of the existence of the big forests of the land much longer. The time is coming when the roads will have to put to use those kinds of wood that now are not desirable for ties. The chemical treatments used for lengthening the life of the inferior qualities eventually may serve to solve the great question satisfactorily, but within the next twenty-five years I predict metallic ties will be necessary things. At this time metallic ties are undesirable chiefly because of the high price of the metal of which they are made."

We are inclined to think that Mr. Wallace overestimates the time when metallic ties will become a necessity. During a conversation that the writer had recently with Mr. Carnegie on this subject, the great steel maker agreed that tie-making would be the next great demand for steel, and he believed that the price would be made satisfactory.

Failures in Doctoring Feed Water.

A famous poet tells that it is better to endure the ills of malicious fortune than to fly to others which we know not of. That is a form of advice which will be recognized as sensible by those who have endured without patience the evils of hard feed water and have resorted to chemicals to make it soft. A well-known chemist, Mr. W. H. Edgar, president of the Dearborn Drug and Chemical Works, of Chicago, some time ago gave a talk to the Western Railway Club on "Boiler Feed Waters." While dealing with boiler feed water treatment he expressed the opinion that all attempts to purify or soften hard boiler water had failed. This view, coming from such a high and impartial authority, ought to be accepted as decisive.

In his talk Mr. Edgar went on describing a great many reagents that would neutralize the effects of lime or magnesia salts and prevent them from forming scale in boilers. But the information was given that the water of each well or brook required treatment adapted to the impurities it contained. That has been the difficulty all through this water purifying crusade. As it would require a man with considerable knowledge of chemistry to carry out the operations at each water station, doing the work in that way has been regarded as impracticable, and the all round panacea of charging the water with carbonate of soda has been extensively followed with very pernicious consequences. In laboratory experiments it has been found that a great many substances when mixed with water containing lime will enter into chemical combination with the latter, forming an insoluble mixture that is deposited in the form of mud. Barium and ammonia are used to test the presence of lime compounds in water, and they could be used as precipitates were it not that cheaper drugs have been found equally efficient for boiler treatment. Mr. Edgar, in the following part of his remarks, gave almost a complete history of the attempts made to render lime in feed water innocuous:

"In the early days when we first used high pressure, in Scotland they introduced potatoes and got some results which were due to the tannin in the potato peel and the pulp boiling into starch and from that to sugar, giving a saccharite, and the reactions could possibly be written as tannates and saccharates of lime. Later on sugar was recommended by German chemists, which has been successful in some cases. Then we have fluoride of sodium, phosphate of sodium, carbonate of sodium; all have been recommended as a boiler compound, or as a possible antidotal reagent. The reason why sodium salts have failed is as follows:

"Carbonate of soda will convert a certain amount of sulphate of lime into carbonate of lime, and any excess of the carbonate of soda ought to keep the normal carbonate of lime in solution as a bicarbonate sludge, or partly so.

"A short time ago fluoride of soda was recommended, because the calcium fluoride is a flocculent precipitate, which would not adhere and could be readily washed out. They did not figure on what would become of the soda base. After the exchange the soda would naturally go to the carbonate and to the sulphate, and the lime would go to the fluoride, the soda salts being left in solution.

"Later on phosphate of soda was suggested as a reagent for the lime salts, and worked out the reaction as a tri-basic sodium phosphate. In the exchange the sulphate and carbonate of lime would be converted into $Ca_3 (P O_4)_2$—tri-calcium phosphate, so that one pound of the phosphate of soda would convert three pounds of the scale incrustation into sludge, which readily washes out; but we have the same soda salts in solution."

A variety of other soda compounds were discussed, but the ultimate objection to them all was that the soda was left in the boiler, and it made vicious combinations of its own not figured on in scale prevention philosophy, and caused the boiler to foam. What soda compounds ought to do in the prevention of scale are theories founded upon laboratory experiments; and they may or may not act as they ought to do. In many cases there is good reason for doubting the remedial effects of soda upon the scale, but there is no doubt about the fact that its presence causes boilers to foam.

Lime incrustation is a bad thing for boilers. It puts a non-conducting coating between the metal surfaces and the water, causing over-heating that shortens the life of furnaces and flues; and the heat from the fire gases is not absorbed by the water so effectually as it would be with clean heating surfaces. This increases the expense of operating a locomotive, and raises the cost of motive power so it is natural that motive power men should readily grasp at any remedy which promised to rob the lime of its evil tendencies. We are afraid that this grasping has been done without proper study of the whole problem. Boiled scale is an expensive thing to wrestle with, but it is likely enough that the remedies resorted to cost two dollars where scale troubles cost one.

Steam engineers are aware that an enormous amount of the heat generated in the boilers feeding steam engines is lost through what is known as cylinder condensation. First-class stationary engines, well housed, with cylinders well protected from atmospheric chilling, frequently lose as much as 25 per cent. of the vitality of the steam through cylinder condensation. Locomotives, with their exposed cylinders, are peculiarly susceptible to this kind of heat loss, but the tendency to cylinder condensation is tremendously increased when water enters them along with the steam. When the dryest steam that a boiler will produce enters a cylinder it goes into a vessel colder than itself, and the steam gives up part of its heat to bring the metal of the cylinder up to its own temperature. As the steam has no more heat than what is needed to keep it in gaseous form, the heat abstracted permits a portion of the steam to turn into water, which has no power to do work in pushing the piston. That condition is always present, but it is very much magnified when water passes from the boiler to the cylinders; for the water seeks heat to revaporize it, and draws what it can from the cylinder metal, thereby cooling it so that the cylinder acts as a condenser of the steam entering it. It is safe to assume that the wet steam that passes from a boiler saturated with soda loses at least half its efficiency for doing work. There is no road using much soda in the boilers of locomotives that does not have trouble from engines steaming badly. There is every reason to believe that this results, not from the boiler not generating a sufficient supply of steam, but from the cylinders condensing it before useful work can be performed. When this is the case the railroad companies are paying very dearly for their attempts to make soda neutralize lime salts.

We have no intention of posing as alarmists, but we have given this subject a great deal of earnest investigation; and we are convinced that nearly all railroad companies would profit by abandoning the treatment of feed water by soda compounds. What they ought to do is to devote careful attention to the selecting of the best feed water that can be obtained, and where the use of hard water is inevitable to strive by careful washing out to reduce the destructive effects of lime and magnesia. If half the labor and expense that have been expended on chemical compounds had been expended upon thorough methods of washing out the boilers, there is every reason to believe that great saving would have resulted. Washing out is a common operation that does not appeal to the scientific mind, but it is the kind of work that saves trouble. Treating feed water with chemical compounds being an acknowledged failure, we recommend the labors of the humble boiler washer as the best way to rob bad feed water of its destructive effects.

Double Heading in Texas.

Double heading, or putting two locomotives in the front of a train is unpopular wherever it is in practice, but railroad companies adhere to it for the simple reason that it reduces the expense of moving freight and passengers. Several efforts have been made to have railroad commissioners to condemn the practice, but every attempt of the kind has resulted in failure. The latest case was an appeal to the railroad commissioners of Texas to prohibit the practice of double heading. No decision has yet been arrived at, but the railroad companies are doing their best to prevent the railroad commissioners from interfering. The following is the conclusion of a brief filed by the Southern Pacific Company:

"We submit that the railroad commission cannot find from the evidence on this hearing that the operation of double-headers necessarily involves in the aggregate a greater degree of hazard than the operation of trains drawn by single engines, much less can your honors find that there is an unreasonable degree of hazard incident to the double-headers as operated on the Galveston, Harrisburg & San Antonio Railway. The problem of extra and unnecessary danger is largely one of relative skill and equipment. As a general rule, it is safe to leave the system of train service to the railroad companies as a question of economy; for capital is no less timid than labor, and the railway companies will naturally seek to avoid those methods and practices which tend to involve the damage and destruction of their property, to say nothing of individual damage suits. A favorite generalization of counsel for complainants is that the dangers increase directly in proportion to the strength of the engine and length of the train, and that it requires proportionately stronger equipment and greater skill to operate a long train and overcome these additional hazards. If it be conceded, still in this light it would be as logical for them to demand a restriction of the number of cars in a train to five or ten as to seek the prohibition of double-headers. Certainly there can be no reason why this commission should adopt any order having the effect of forbidding, or in the slightest degree restricting, the use of double-headers as now operated on the Galveston, Harrisburg & San Antonio Railway, and aside from theoretical considerations, we frankly suggest that the experience of this company in the operation of double-headers, as shown by practical and undisputed testimony, demonstrates the wisdom of a policy that shall leave the matter largely to the sound business judgment and foresight of the manager and his associates."

Using Acid to Prevent Foaming.

A short time ago a correspondent asked us if powdered bluestone would prevent a boiler from foaming and, if so, why. We answered that it would prevent foaming because the acid would neutralize the substance that causes boiler to foam; but at the same time we cautioned our readers against the use of sulphate of copper (which is the proper name for bluestone), because the sulphuric acid in the compound might attack the steel plates. Since this advice was given, we have learned that the use of sulphate of copper to prevent boilers from foaming is quite a common practice. This knowledge leads us to return to the subject.

The use of acids to prevent boilers from foaming is sending a thief to catch a thief.

It works all right, but it is a case where the first thief ought to be prevented from stealing. In other words, soda is put into the feed water to catch certain lime salts, which it does not always do; but it remains in the boiler to cause foaming, and so the acid is sent after the soda to settle its turbulence. Acting in combination with some other impurities which it finds in the boiler, the soda forms suds which pass into the dry pipe with the steam and thence into the cylinders. How the acid acts to subdue the suds can be readily illustrated in any household. Take a basin of water and rub a piece of soap in it till suds are formed. Then pour a little vinegar into the water and try to form suds afterwards. That is a good object lesson.

We think keeping the soda out of the boiler is the safest remedy for foaming, but if circumstances call for an antidote, we should recommend the use of acetic acid or other organic acid drawn from what is known as the methane group of hydro carbons. They have little or no tendency to attack iron. Besides having a tendency to attack the steel of the boiler under favorable circumstances, the mineral acids are liable to make new scale-forming complications that the use of soda is designed to neutralize. If the sulphuric acid in the bluestone does not find enough soda in the boiler to satisfy its affinity for a base, it is likely to combine with lime and produce sulphate of lime, the worst scale-making compound that boiler users have to contend with.

Dealing With Break-Downs.

Engine truck axles do not break off very often nowadays, thanks to the care taken of them and to their generous size in proportion to the work they have to do; but the flanges go pretty often. If they break when rounding a curve the front end of the engine is liable to get off the track, and be followed later by the whole train.

When a flange breaks, if the engine stays on the rail, that is, the rest of the wheels, the first thing to be done is to get the disabled pair of wheels back on the rail. If only a part of the flange is broken off, the engine may be run to the next siding, or to a terminal, by one of the following methods, where a new pair of wheels may be put in:

If the tread is all right and the wheels on the other side of the track have good flanges, chain the corner of the truck next the disabled wheel to the engine frame across on the other side. This will tend to crowd the good flanges against the rail and the disabled flange away from the rail, so that the wheel cannot get off the track. If you have no chain, you can crowd the truck over with a block of wood from the truck frame next the good wheel to the engine frame over the broken wheel. This same method can be used in case of a broken flange on a tender truck wheel.

If a piece of a truck wheel is broken out so it will not run, with a spoked wheel stick a pinch bar through the spokes so the wheel can't turn around, and hold the good part of the wheel on the rail. Then slide it to a side track. With a plate wheel wedge a block of wood between the broken spot and the truck frame. This will hold the wheel from turning around. With chilled wheels it will not be a very great loss to skid them in to clear.

If the wheels are steel tired, it is worth while going to considerable trouble to save the good wheel. Jack up or raise the corner of the truck till the disabled wheel clears the rail; block up under the journal next the disabled wheel with a good solid block of hard wood on the pedestal brace, and chain that corner of the truck to the frame above so the good wheel on the other end of the axle will stay on the rail, just the same as you fix a driving wheel with a broken tire. If the chain is hitched to the bottom corner of truck frame and up around a bar across the engine frame it will tend to swing it properly. With some makes of ten-wheelers the valve rod and rocker arm come in the way of chaining up the back wheel. When you block up and chain up a forward engine truck wheel, remember that the back wheel then has to carry all the weight on that side of the truck. Make a good job of chaining it solid; it may be necessary to block up over the forward driver on that side. With a truck wheel broken off the axle outside the box, fasten that corner of the truck frame up and let the other three wheels carry it.

Sometimes it is easier to take a big hard wood tie, cut a couple of notches in one side of it, one for each wheel, so the truck wheels will run up on the tie, lock fast there and not turn. You can slide them quite a ways with the tie taking most of the weight, and get on a siding. It is an easier matter to handle a front pair of wheels this way, as the binders on the bottom of the frame come in the way with the trailing or rear pair of engine truck wheels. When a tender truck breaks down it usually makes quite a smash up of the truck; it is more trouble to pick up the pieces and get ready to block up than all the rest of the work. We once saw a back tender truck badly broken up, only a pair of wheels and their axle being left whole. The engineer jacked up the tender, got all the broken material out, then rolled the good wheels under the back end of the tender, put two ties across the axle, one next each wheel lengthways of the tender frame, and two other ties crossways of these and under the frame. This held the tender frame up clear of the wheels, so he went in for repairs. The axles wore into the ties some, but not enough to hold him back any. If one axle or journal breaks and does not tear the truck up, get the broken parts out, raise up the tender block between the top of the oil boxes on the good axle, so that carries the weight of that part of the tender. You can then sling the disabled corner of the truck to a tie which crosses the top of the tender. There will be less strain on the chains if the blocks carry the load. If the standard freight car truck will fit under a tender, put one of them in place of the disabled truck—better have a freight car lying idle than a tender.

Bear in mind that one of the first things to think of when blocking up is to get the main track clear as soon as possible, ready for the safe passage of trains. That gives a chance for a man to show his ingenuity in devising means to get under way quickly and safely.

A New Wind Splitter.

If the Baltimore & Ohio Railroad Company do not contribute their own share towards the trouble and expense of scientific inquiry about the resistances encountered in moving trains it is not the blame of the officials. To put any untried apparatus upon a passenger train that is run at high velocity is a privilege that railroad officials have very rarely accorded to inventors. This is probably due to the fact that were every inventor who is prepared to put upon a locomotive or train a device which promised to save half of the coal, or to double the speed of the train on a given expenditure of fuel, given unlimited encouragement, every train in the country would be equipped with some patented apparatus that would make the lives of trainmen miserable. But the Baltimore & Ohio people have permitted one Frederick U. Adams, of Chicago, to equip one of their trains with a most elaborate apparatus, calculated to reduce the air resistance of trains. The newspaper accounts of the tests would lead the public to believe that the invention works with entire satisfaction.

The principle of the invention is to provide a wedge-like attachment to the locomotive which will cut the air like a knife, this being supplemented with other appliances calculated to prevent the different cars in the train from catching on to the air resistance.

The idea is all right, but, unfortunately, experiments made many times have proved that the reduction of air resistance does not work out in actual service as the invention of Mr. Frederick W. Adams ought to do. Very exhaustive experiments, or rather experience was obtained within the last few years by the Paris, Lyons & Mediterranean Railway with air splitting fronts upon their locomotives, and the practice has been abandoned, because it was found that it did not reduce the air resistance to any appreciable extent. That ought not to be the case, but somehow it is. Facts are stubborn things that are not easily gotten over, and the fact proved by numerous experiments is that putting a sharp point to a locomotive does not enable it to penetrate the air more easily than a blunt front. We think this is due to the fact that a locomotive running into the air carries in front of it a wedge of air. which is just as efficient a wedge as one made from steel or iron.

People have been keeping records so long of the force exerted by air in motion and of the resistance it presents to moving bodies that accurate data ought to be found in engineering manuals, but such is not the case. There are no facts relating to wind pressures and air resistances that the scientific world accepts as correct. The formula for wind pressure generally used was established over a century ago by Smeaton, the famous engineer who built the Eddystone Lighthouse, and those who ought to know say that it does not come within 25 per cent. of the truth. If you set up a board, say, 3 x 4 feet, and expose it directly to the wind, the pressure will be about 12 per cent. less in the center than that due to the calculated force of wind velocity. This would seem to indicate that a body of static air collects in the center and protects the board from the full blow delivered by the moving air. The same static body may form a wind-cutting wedge in the front end of a locomotive. Anyone who has worked upon the front deck of a locomotive running at great velocity is aware that an indicator diagram or other light substance, slipping out of the hand, does not fly back towards the train, but always goes out to the side. It has not been definitely settled what form goes through the air with the least resistance any more than the best model of vessel for passing through the water has been settled upon. If we are to take nature's works as models, we will not use a sharp-pointed wedge as the best air splitter. The most rapid flying birds have a rounded breast that is not sharp, and they have a long tail that does more than steady the animal in flight. The tail lets the bird glide through the air without forming a partial vacuum behind it. Our experimenters with shapes to make trains pass through the air easily generally neglect the necessity for a tail. This defect has been remedied by Mr. Adams, who is probably aware that experiments show that the pulling-back action on the last car is nearly as great as the resistance encountered by the front of the engine. One great point overlooked, however, is that the most train resistance comes from a side or quartering wind. This forces the train against one rail, and the flange friction is enormous; and this no form of shield is apt to prevent.

Steel Boiler Tubes.

Railroad men who endeavor to keep themselves informed about the progress of their business will be interested in knowing that the United States Government have ordered cold-drawn, seamless steel tubes for all the boilers to be used in the new vessels for which appropriations have recently been made. The United States naval authorities, who are extremely conservative in making changes, have long favored charcoal-iron, lap-welded tubes, and it was only within the last few years that they consented to try steel; and the seamless steel tube has proved so satisfactory that they have finally decided to use nothing else.

Railroad men, as a rule, are wedded to iron tubes, but we think that it is time they were moving with the times, which now point to basic open hearth steel as the best material for making a tube that will withstand the dreadful stresses to which the tubes in a locomotive boiler are subjected. A boiler carrying 200 pounds of steam or over is much harder to keep in perfect order than the boiler was when 130 or 140 pounds was the prevailing steam pressure. The more difficult condition has called for the improved material, and experience has demonstrated that the scientific engineering world has been correct in recommending the highest grade of steel for tube making purposes. The British Government made extraordinarily exhaustive tests to find out what kind of material made tubes that would best withstand the stresses of boilers used in torpedo boats, and they decided in favor of steel. That was several years ago, and nothing but steel tubes has been used in British naval boilers since that day.

The basic open hearth steel used in making tubes nowadays has about the same characteristics as the very best grades of charcoal iron had twenty years ago. The analysis of this steel runs from .05 to .08 carbon, about .03 phosphorus, about .03 sulphur, and from .15 to .25 manganese. That is very nearly the same material as the Burden iron was when it gained its popularity. The railroad men who fear the name of steel when it appears in the form of a boiler tube nearly all believe that the steel cannot be welded, but that is a mistake. It welds as well as common iron, when the man doing the work is skillful at his business. This is the age of steel, and all concerned may as well fall into line now as users of steel tubes. There has always been a fight against accepting steel for railroad rolling stock, but the merit of the material always makes it win in the long run.

BOOK NOTICES.

"Mechanical Ventilation and Heating by a Forced Circulation of Warm Air," by Walter B. Snow, is a reprint from the lecture on that subject delivered at Cornell last winter. It is well illustrated, and shows what has been done in many places, some of them machine shops. Its thirty-two pages are full of useful information to those interested in this line of work. We believe copies will be sent on application to the B. F. Sturtevant Company, Boston, Mass.

"Compound Engines," by F. R. Low. Published by Power Publishing Company, New York. Price, 50 cents. This is a reprint of a lecture by the editor of *Power*, which has been nicely printed and bound in flexible cloth, uniform with the one on "Condensers," mentioned in a previous issue. It is a concise explanation of the principles of compounding, and contains many rules and illustrations. While it deals exclusively with stationary practice, the principle of compounding is the same, and is very clearly explained. We have no hesitation in commending the book.

"Technic of Mechanical Drafting." By Chas. W. Reinhardt. Published by *Engineering News*, New York. Price $1.

As the title indicates, this deals with the "technic" of drawing, showing correct shading, section lining, etc., of many subjects, which are largely in civil engineering lines. Mr. Reinhardt probably has no superior in his line, which is, drawing for reproduction by photo-processes; but the draftsman of to-day has little time for sections and shading, and, in fact, the former is not at all desirable in working drawing.

The annual catalogue of the Purdue University for the course 1900-1901 has been received. It shows a very exhaustive course of study in all the lines where instruction is carried on in the University. There is a supplementary catalogue announcing the courses in railway engineering and railway management. It gives a great deal of particulars about the excellent engineering course of Purdue University, and especially that relating to railroad engineering. We advise anyone interested in having a good engineering education given to one preparing for railroad life to send for this catalogue.

"Machinists' and Draftsmen's Handbook." By Peder Lobben. Published by D. Van Nostrand, New York. Price $2.50.

The author of this expresses a desire that the book may be a help to the working mechanics of the world, and a paragraph of his preface indicates that he is on the right track. He says: "The use of abstract theories and complicated formulas is avoided, as it is thought preferable to sacrifice scientific hair-splitting and be satisfied with rules and formulas which will give intelligent approximations within practical limits, rather than to go into intricate and complicated formulas which can hardly be handled except by mathematical experts." He gives briefly, but quite clearly in most cases, the rules of arithmetic and algebra that are needed by the mechanic. This includes algebra, logarithms, geometry, trigonometry, mensuration, etc., all of which are useful and necessary at times. Strength of materials and laws of mechanics are treated, and cranes, derricks, belts, shafting, etc., all receive attention. It is a book which any mechanic will find useful.

Engines for Sweden.

The Richmond Locomotive Works have just completed and shipped to the Ystad Eslof Railway, one of the private roads of Sweden, three 16½ x 24-inch ten-wheeled locomotives with six-wheeled tenders.

The engines were designed throughout

HEAD ON.

by the Richmond Locomotive Works, and, with the exception of the smoke-box door, buffers, snow plow, English vacuum brake, copper firebox and stays and a few other minor details, are in accordance with American practice, which was the express wish of the railway company.

Three photographic views of one of the engines are shown herewith, and it is interesting to note that the engine has no bell and that the reverse and all operating levers are on the left-hand side of the engine, which is the general practice in Sweden.

Mr. Dan Olson, mechanical engineer of the road, inspected the engines during their construction. The general dimensions of the engines are as follows:

Gage—4 feet 8½ inches.
Fuel—Coal.
Weight on drivers—72,600 pounds.
Weight in working order—99,100 pounds.
Wheel-base, driving—12 feet 1 inch.
Wheel-base, total engine and tender—43 feet 4 inches.
Total length of engine and tender—53 feet 2 inches.

Cylinders:

Diameter—16½ in hes.
Piston stroke—24 inches.
Piston packing—U. S. Metallic.

Slide Valves:

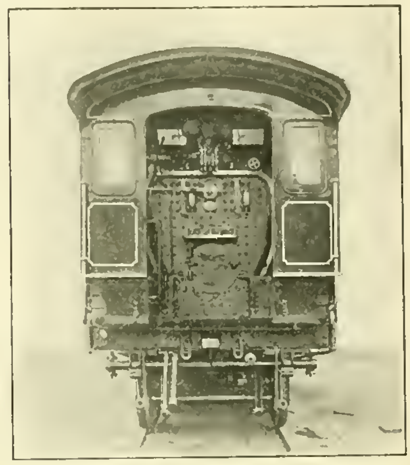
Style—Richardson balanced.
Greatest travel—5¼ inches.
Lap—Outside, ⅞ inch; inside, 0 inch.
Lead in full gear—1-32 inch.
Valve stem packing—U. S. Metallic.

Wheels:

Driving, diameter—60⅝ inches.
Driving, axle journal—7 inches diameter by 9 inches.
Crank-pin, main—6¼ x 5 inches, 5½ x 6 inches.
Crank-pin, side rods—4 x 3⅜ inches.
Engine truck, wheels—28 inches.
Engine truck, journals—5 x 10 inches.

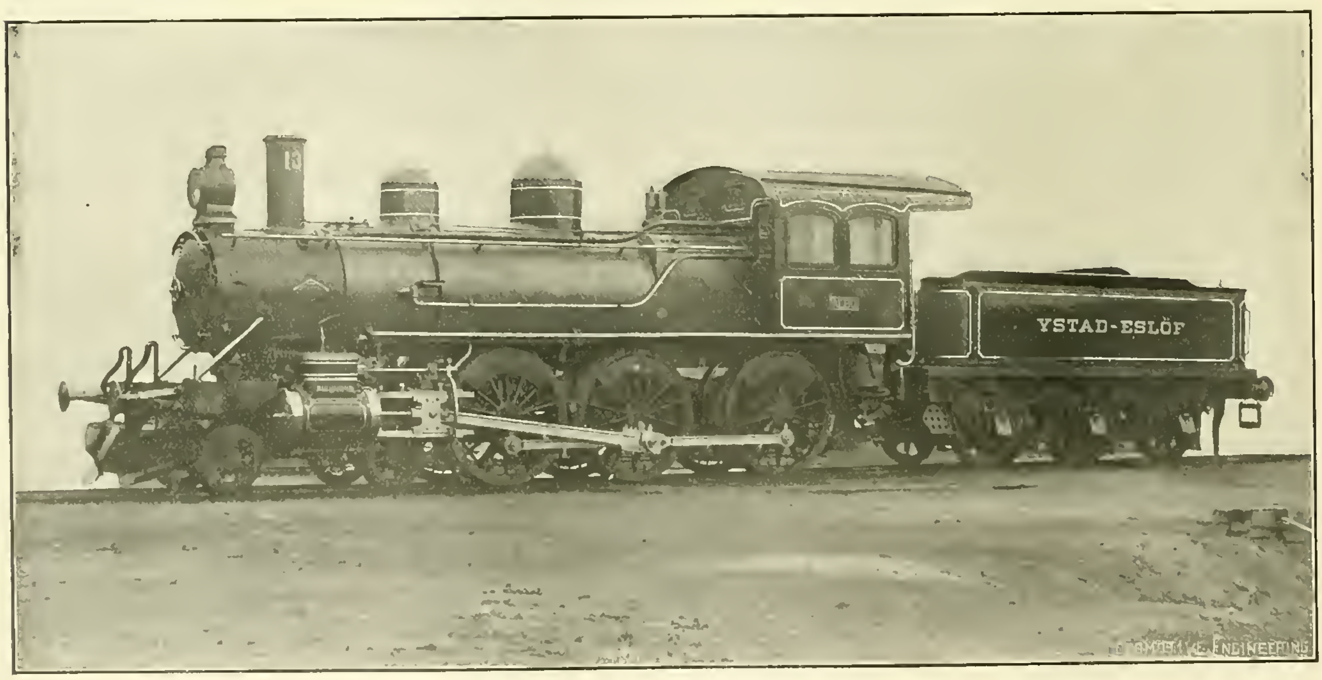
Boiler:

Type—Belpaire, straight top.
Working pressure—185 pounds.
Outside diameter, first course—51 inches.
Thickness of plates—In barrel, ½ and 9-16 inch; roof and sides, ½ inch.
Seams—Circumferential, double riveted; horizontal, butt and sextuple riveted.
Firebox, length—74 inches.
Firebox, width—34¼ inches.
Firebox, depth—Front, 58 inches; back, 48½ inches.
Firebox, material—Copper.
Firebox, plates—Sides, ½ inch; back, ½ inch; crown, ½ inch; tube, ⅞ and ½ inch.



LEFT-HANDED CAB.

Firebox, water space—Front, 4 inches; side, 3 inches; back, 3 inches.
Firebox, crown-stays—1-inch iron.
Firebox, staybolts—1 and 1⅛-inch hollow copper.
Tubes—Length, 12 feet 6 inches; number, 178; diameter, 2 inches; thickness, No. 12.
Heating surface—Tubes, 1,164 square feet; firebox, 98.5 square feet; total, 1,262.5 square feet.
Grate area—17.72 square feet.
Feed water supplied by two 7½ Sellers injectors.



RICHMOND LOCOMOTIVE FOR SWEDEN.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Calculations of Brake Cylinder Pressures.

We have had considerable correspondence from time to time regarding the amount of pressure had in the brake cylinder after certain train pipe reductions had been made, but owing to the unsatisfactory manner in which the problem must be handled, and that equations must be used, we have answered such correspondence by private mail rather than run the risk of getting beyond the depth of some of our readers, and thereby incur their displeasure. But the time has now come when the subject must be taken up in the columns of the paper, and we ask that readers go through the calculations carefully and slowly, seeking out the reason for each step, and not condemn the method because it requires the use of equations. The simplest mathematics possible have been employed.

It must be understood at the outset that the method obtains only approximate results. To get a strictly accurate result many things would have to be taken into consideration which we cannot now afford to take up, inasmuch that so doing would make the method so cumbrous and abstruse as to render it of value only to persons with a good knowledge of higher mathematics. So, in order to arrive at a fairly approximate method within the reach of all—one that is close enough for ordinary purposes—we will wittingly disregard some rather important technical considerations, which, if followed up, would bring to a few persons a closer and even accurate result. However, we will mention some of the most important of these considerations which we are purposely neglecting.

First—The first air which goes to the brake cylinder does work by pushing the piston out, consequently lowering the temperature and thereby reducing the pressure of that air. Just how much the temperature is lowered and the pressure reduced we will not follow up. Neither will we compute the loss or gain in cylinder pressure due to the difference in temperature of the brake cylinder air and the walls of the brake cylinder and face of the piston.

Second—The air going to the brake cylinder after the piston has been pushed out does no work; hence there is no change in its temperature. Whether there is a loss, and just how much it is, when this air meets the first air and walls of cylinder and face of piston, which are lower in temperature, we will not follow up. Suffice it to say that there is a loss.

Third—We will not measure the loss of pressure through the leakage groove and what escapes around the packing leather before it sets out firmly. But there is another loss.

Fourth—When the triple piston goes to service application position the auxiliary reservoir is increased in volume some few cubic inches over that volume when the piston is in the full release position. We will ignore this fact also.

Fifth—When the piston in brake cylinder is in full release position it stands away from the head a distance equal to the thickness of the follower head nuts. This clearance, along with that of the uneven surface of the follower plate and that of the pipe connecting the auxiliary and brake cylinder we will assume is equal to 1 inch clearance or 1 inch piston travel. So, in calculating results of a 6-inch travel we will actually figure it a 7-inch travel. This is an assumption, but is approximately correct. Purposely neglecting these points, which are necessary for an absolutely accurate result, we will proceed:

Given, an auxiliary reservoir 12 x 33 inches and 10-inch brake cylinder at 6-inch stroke. Seventy pounds in the auxiliary reservoir. What pressure will be had in brake cylinder with a 10 pounds reduction? Method: A 10 x 33-inch auxiliary has a capacity of 3,030 cubic inches, and a 10-inch brake cylinder at 6 inches travel has 546 cubic inches. If each cubic inch of the auxiliary reservoir hold 70 pounds, then the whole auxiliary will have a total pressure of 212,100 cubic inch pounds. Now, after the 10 pounds reduction is made, this total amount of pressure is distributed. Part remains in the auxiliary reservoir, part has gone to the cylinder to push out the cylinder and fill up what would have been a vacuum had the piston been pulled out by some outside force instead of being pushed out by air pressure, and part goes in on top of this last amount and makes gage pressure. These three places hold what was originally in the auxiliary reservoir, and must equal it. These amounts we will represent respectively by the following equation:

$$(3030 \times 60) + (546 \times 14.7) + (546\,P) = 212100,$$

where 14.7 is the pressure consumed by the vacuum in the brake cylinder while the piston is being shoved out, and P is the unknown pressure in the cylinder after a 10 pounds reduction. By performing the multiplication indicated, we have

$$181800 + 8026 + 546\,P = 212100.$$

By holding the unknown quantity on the left-hand side of the equation and transposing the known to the right-hand side, where they become minus, we have

$546\,P = 212100 - 181800 - 8026$, or

$546\,P = 22274$, therefore

$P = \frac{22274}{546} = 40.7$, which is the amount in the brake cylinder. But this is the absolute pressure, and to get gage pressure we must subtract 14.7 from the 40.7. This will give us 26 pounds, the amount which the gage should show under the above conditions. But as we have neglected all losses as above mentioned, we may naturally expect this figure to be too high, which it is, between 7 and 10 per cent.

Problem 2: With a 12 x 33-inch auxiliary and 10-inch brake cylinder, 70 pounds auxiliary pressure, what will they equalize at with respectively 6, 8 and 12 inches travel? Taking the capacities as in preceding problem, we assume that an application has been made, the pressures equalized, but we have not read the gage. The pressures may then be designated as follows by the equation:

$$(3030\,P) + (546 \times 14.7) + (546\,P) = 212100.$$

Holding the unknown quantities on the left-hand side, and transposing the known to the right, we have

$$3576\,P = 212100 - 8026 = 204074,$$

therefore $P = \frac{204074}{3576} = 57$ pounds, which is also between 7 and 10 per cent. too high.

Likewise, the process would give 54 pounds and 48 pounds respectively for the 8 and 12-inch stroke. These pressures are also too high, owing to the neglect of the five considerations above.

As already stated, this method is only approximate, and only applicable to those cases where persons desire an approximate answer, it being believed that a real test on the actual apparatus would be preferable and would be resorted to if anyone wanted strictly accurate figures.

Arrangement of Brake Cylinders and Levers on English Freight Car.

A sketch elsewhere in this department illustrates the location of brake cylinders and arrangement of cylinder levers on a gondola freight car recently built by one of the large British railway companies in England. The cylinders are of the double-piston form, acting opposite to each other. Two cylinders are placed on each car, and fastened by the usual bolts to the car body, although not so shown in the sketch. The whole, viewed from an American point of view, appears cumbrous and as having a number of superfluous parts. But it has also that substantiality peculiarly English, and the neutralizing forces of the opposing pistons insure the cylinder remaining tightly bolted to the car body.

CORRESPONDENCE.

Conductor's Valve and Cord.

Editor:

In passenger equipment, the conductor's valve and the corded signal valve are supposed to be air appliances of great benefit. Putting these valves on a coach is all that is necessary. As a matter of fact, they are not usually of service when needed. The car discharge valve (signal) is supposed to, and should, be corded from hood to hood throughout the car's length. On most roads this cord is only inside the car. The conductor's valve used to be corded inside the car, too, but at one side, over the windows. The passengers often pulled the cord, imagining that they were on a street car; so that most roads omit the cord to the conductor's valve.

A while ago I was on a local passenger train, and after starting from a country station, two women, one with a child in her arms, discovered that they should have left the train at that point, and made a rush for the platform. The conductor, coming through the smoking car saw them attempting to get off, and pulled the signal cord, making a rush for the platform to intercept them. Too far away to reach them, and the effect of getting brakes applied through the train air signal too slow, and the conductor's valve a local affair at the other end of the car, only for the fact that a man—a passenger—standing on the platform, prevented them in their excitement from jumping off, there would probably have been a distressing accident—and a law suit.

The chances for this trouble that occurs daily, can be prevented with little expense, just a little attention to the requirements of passenger service. The opinions of our passenger trainmen are of value, and I give them.

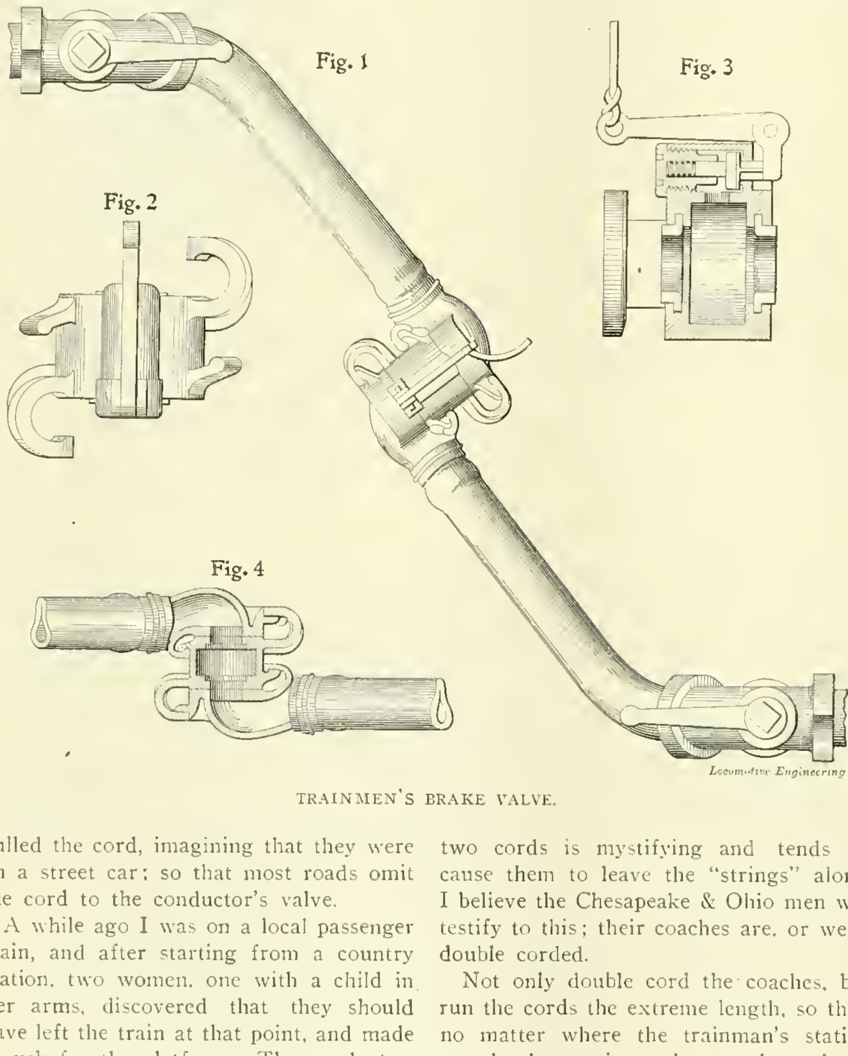
Have passenger equipment cars double corded, the lower cord attached to the signal discharge valve as usual, the upper cord, swinging 6 or 8 inches above it, to be connected with the conductor's valve. This valve should be of the pattern of the signal discharge valve, but larger, to exhaust pressure quickly from the ¾-inch branch of train pipe. If passengers "monkey" with the cords, they will naturally pull the lower cord (the signal). This they often do anyway; but there being two cords is mystifying and tends to cause them to leave the "strings" alone. I believe the Chesapeake & Ohio men will testify to this; their coaches are, or were, double corded.

Not only double cord the coaches, but run the cords the extreme length, so that, no matter where the trainman's station may be, he can instantly stop the train or signal to the engineer.

I believe that the Westinghouse Air-Brake Company should bring out a new conductor's valve and recommend the double-cording system. The old thing is out of date. I was sitting in the smoking car of one of our "high-speed" vestibule trains, the other day, talking to the conductor. I called his attention to a noisy passenger at the forward end of the car. "Suppose that fellow took a notion to jump off the train, what would you do?" "Why, I would pull the conductor's valve." I asked him where was the conductor's valve, and he went toward the opposite end of the car from where it was, to find it.

Run cords from the conductor's valve, and from the car discharge valve from one end of the coach to the other—extreme lengths.

WILL W. WOOD,
A.-B. Insp., C., I. & L. Ry.
La Fayette, Ind.



TRAINMEN'S BRAKE VALVE.

Trainmen's Brake Valve.

Mr. J. J. Sullivan, foreman of the Louisville & Nashville Railroad at Louisville, Ky., has invented a trainmen's brake valve. This valve is a device which is interposed between the hose couplings, as shown in Fig. 1 of the accompanying sketch, and is connected to a cord which runs to the top of the car near the hand-brake wheel, and by which the trainmen may make a service application of the brake while the train is running. Fig. 2 is a plan view of the device. Fig. 3 is a sectional view of the valve on a vertical plane. Fig. 4 shows a modification of the device in a form which permits the signal hose and air-brake hose to be coupled together when it is desirable to use the signal pipe for a train pipe, should accident so necessitate.

Test of Water Brake.

Editor:

For the information of your readers, I send you the following account of the series of tests to ascertain the retarding power of the water brake made on May 9, on the Mountain division of the Maine Central Railroad.

These tests were made under the immediate direction of Mr. George F. Black, superintendent of this division. There were also present Mr. Henry S. Kolseth, representing the Westinghouse Air-Brake Company, and Mr. C. F. Keith, traveling engineer, representing the motive-power department of this road. The engine was handled by Engineman W. H. Yates, of this division.

One of the objects of these tests was to determine the percentage of air-brake cars required in a train to descend the mountain safely without the help of any hand brakes. Another object was to ascertain, by actual road tests, the retarding power to be obtained from a locomotive running reversed, and equipped with the water brake.

The grade on which these tests were made is 116 feet to the mile; the engine used, a mogul, 19 x 26 cylinders, wheel 56 inches; steam carried, 150 pounds. The weather was misty, and a portion of the time during tests light rain fell, giving a rather poor rail, although sand was used when needed.

The first run was from Crawfords to the Willey House, 4 miles, speed 12 miles per hour, which is schedule time for freight trains on this grade. There were five cars. Weight of cars was 324,500 pounds; weight of engine and tender, 176,-680 pounds; total weight, 501,180 pounds.

It was thought that this train would be all that the engine would be able to control, as, while the air brakes on all cars were coupled up and tested before starting (as indeed all trains are at this point), no air brakes were to be used during the tests, unless the water brake should fail to hold the train, in which case the air brakes were to be used.

The run was made in 19 minutes, with very uniform speed, and the train stopped at the Willey House readily, with the water brake alone. During the most of the run the lever was notched only half-way back of the center of quadrant, showing that there was quite a reserve power which was not needed on this run.

This test was so satisfactory that on the next trial the train was increased to eight cars, the weight of which was 496,-800 pounds, engine and tender making total weight to be held 673,480 pounds.

The speed on this trial was kept down to about 6 miles per hour, and 42 minutes were used between Crawfords and Willey House, the water brake used alone, even in finally stopping the train.

The tests were now continued with same train, Willey House to Carrigain, a distance of 2½ miles, at a speed of 12 miles per hour; train kept under good control, and the stop at Carrigain made with the water brake alone, before reaching the switch. During this test the lever was notched clear back the greater portion of the time, showing that the limit of what the engine would hold was about reached. From careful observation during the two latter tests, it was evident that the holding power of the engine was better at 12 miles per hour than at 6 miles per hour, and we are of the opinion that the reason is, that at the slower speed much of the compression is lost at the cylinder cocks.

A total of twelve cars was now taken on, and air brakes on three cars and tender put into use, the remaining cars being cut out and bled. The total weight of this train, including engine, was 963,780 pounds, and the run continued to Bemis, a distance of about 2 miles. With the use of the water brake and air brake on tender and the three cars, no difficulty was experienced in holding this train down to a speed of about 12 miles per hour, and stopping it at Bemis.

The brake power on tender and the three cars in use during the last test was 9 per cent. of the total weight of the train. The run was now continued to Bartlett, where engine, tender and all cars used during the tests were carefully weighed, and all foregoing figures are given from these weights; the cars were loaded with grain, and were taken at random. Before descending the mountain piston travel was adjusted on these cars, this being the practice on all freight trains at Crawfords.

The class of engine used during these tests is rated to draw 260 tons, exclusive of engine weight, up this grade. A very interesting point brought out by the tests was the ability of the engine to control and stop, on this same grade, a train of 248 tons weight, falling but little short of what the engine is rated to pull up same grade; and I can assure you these engines are not under-rated.

The valves and cylinder packing of the engine used were tight (no blowing), and it is believed that leaky packing or valves on an engine used to hold trains in this manner would lessen the holding power of the engine, the same as it would reduce the power developed in ascending same grade.

It should be borne in mind that during these tests the speed of the train was at no time allowed to exceed 15 miles per hour, we believing that the great secret of successful handling of trains, particularly freight, down grades of this description, is to apply the brakes early, and keep the train under control from the start, as brake power which would be sufficient to control and stop a train running 15 miles per hour on this grade would have but very little effect on the same train running at 30 miles per hour; and that the cause of many run-aways has been due to allowing the train to attain too high speed at the start.

All engines running on this division are equipped with the water brake, ½-inch pipe tapped into boiler head 3 inches below bottom gage cock, and leading underneath saddle; ⅜-inch pipe each way from tee to exhaust passages, and a drip cock to keep clear in cold weather. Driver brakes on all engines are cut out, and water brakes used if needed while descending this particular grade where these tests were made, it having been found that tight driver brake cylinders, and brake kept applied down this grade, resulted in heating and loosening driving wheel tires.

Frank F. Coggin,
A.-B. Insp., Maine Cent. R. R.
Portland, Me.

Bad Practices.

Editor:

Have you ever stopped to notice the bad practices sometimes employed in oiling air pumps—that is, oiling the air cylinder? When oiling around before leaving terminal station, and when he comes to the air pump, the man with the can will open the small oil cup in the air cylinder and pour in a lot of engine oil, and finish up by giving the swab a dose of the same.

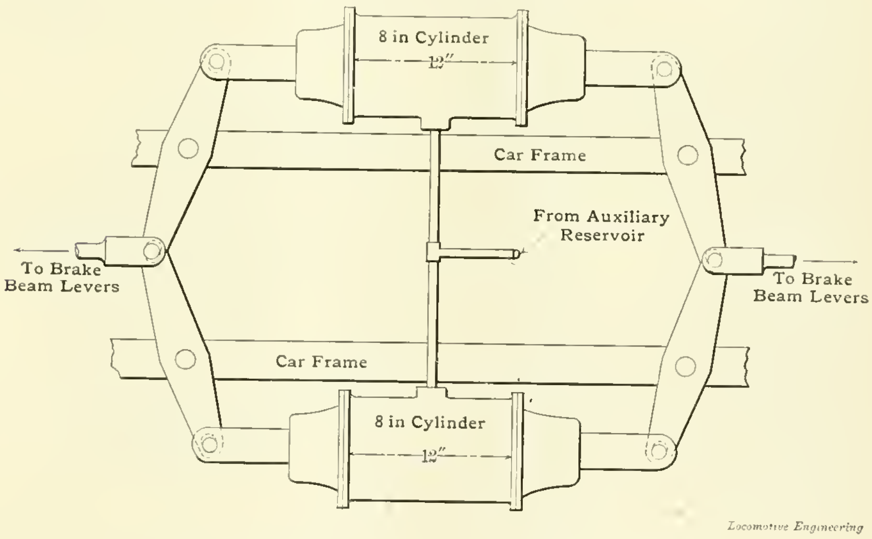
Now, what are the results from oiling in this way? How will your brake valve handle? How about your governor and receiving and discharge valves of your air pump and its pipe connections?

I have seen engines that were run in the pool, and out of thirty-five freight engines there were only a few that carried the right amount of pressure in the train pipe and reservoir. If the governor was not badly gummed up, it was the feed valve. All on account of using too much oil in the air cylinder of the pump.

Here are a few illustrations of the treatment some air pumps get on the road: The shovel will be taken and cleaned off, and into it will be poured about a quart of water. To this will be added about a pint of valve oil. This mixture will then be held under the l wer receiving valve and the air pump will draw it all in.

Occasionally the signal oil can will be taken out on the running board, and into the cup will be poured about a half pint of signal oil, and what are the results? The pump starts to burn up, and if it is not packed with metallic packing it will burn out, and the result is, you have to pack your pump. I have seen pumps run without any packing in air cylinder for over ten miles, on a train of fifteen air-brake cars. Now, what condition was that air pump in after getting that dose of oil?

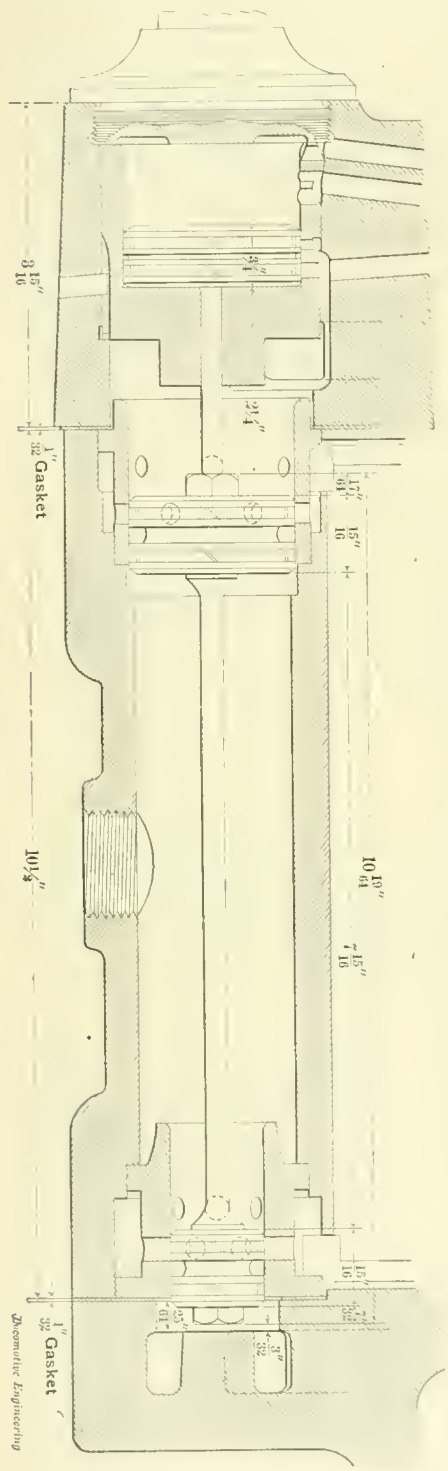
Using too much oil in the air cylinder, so that you gum up your governor and feed valve, will have a good deal to do with sliding of wheels on a bad rail. I have seen governors which had to be



PECULIAR ARRANGEMENT OF BRAKE CYLINDERS AND LEVERS.

cleaned every week in order that they would carry the right amount of air.

By using the brake valve in emergency a good deal of the time, helps to bring the oil and dirty sediment out of the main reservoir which would otherwise stay in the main reservoir; that is, not so much would be brought out into the brake valve



MAIN VALVE DIMENSIONS.

and governors; and if you will take a look at the brake valve of a man who uses the emergency a good deal, and one who doesn't, and if both use a good deal of oil in the air cylinder, you will find the one who uses the emergency most has a badly gummed up brake valve. At the same time, they will be kicking because their brake valve handles so hard.

C. F. SUNDBERG.

Sioux City, Iowa.

Main Valve and Reversing Piston Dimensions for Eight-Inch Pump.

As we are frequently asked the lengths of the reversing piston rod, the main valve rod and the height of the stop-post in the 8-inch pump, we have decided to illustrate herewith a sketch of the main valve and reversing piston in their places in the pump, and thus give the lengths of all these various parts. This is an assistance to air-pump repairmen which we believe will be appreciated.

A Few Suggestions on Handling Long Freight Trains With Air-Brakes.

Editor:

Since the automatic air-brake has been put on freight cars, and the control of the train is placed in the hands of the engineer, there has been little said about successfully handling long freight trains in comparison to what has been written on handling passenger trains.

Most all air-brake instructors say that if the brakes are applied for a slow-down, or you are going to stop too soon, it is better to come to a full stop; then to release if going any less than eight miles per hour, as you run the risk of breaking the train in two.

There is not the attention given to looking after and handling freight trains that there should be. Freight cars, of course, are not loaded with passengers, but they often contain valuable freight, which, if broken, the company handling same has to pay for.

Train line leaks are the freight engineer's worst enemy. A great many roads have their freight cars in good order, while others have not. There are three places in the train line which cause the most trouble, namely, hose coupling gaskets, large union nut at tee connection and the union nut at triple valve.

The best engineer cannot do a good job braking on a long train with a leaky train line. The brakes will be on hard long before they should, and in order to stop the train where he wants to, he will have to release the brakes. And when he does stop, he will not have had the benefit of the brakes he should have had if he had tight train line and auxiliaries; for he will not have time to fully recharge the auxiliaries. Ten cents' worth of repairs may sometimes save the engineer his job and the front end of the engine.

The man who advocates stopping freight trains by putting the brake valve on lap and making the stop with train line leaks, I think, is working for a new kind of an application. It should be called "wrecker" application. I don't believe in this method of braking. The leaks should be tightened up, so the brake may be used as it is intended. I have tested this "let the leaks apply the brakes" method several times and noted the difference between a 5-pound reduction and putting the valve on lap and let the brakes set with train line leaks. You will lose, on an average, about 20 per cent. of the brakes. The reduction is not fast enough to force all the pistons by the leakage grooves. An instructor can show to a class in the instruction car or school plant that a train line leak will set all the brakes in a thirty-car train. The brakes on the average freight car are not so well taken care of as his brakes. Furthermore, all they do is to compress the release spring in the brake cylinder, while the others compress the release spring as well as move the brake rigging, which is pretty stiff on some cars. For the sake of all that is good and true, and in justice to Mr. Westinghouse, who gave us this great invention, let us do, by better maintenance, what we can in the future to help along the air brake and the freight engineer.

Give the following rule a fair trial and watch the results: After the engine is coupled to the train and all air cars charged up, make the usual terminal test. Have the inspector report to you how many brakes are working. Keep the engine from blowing off while the inspector is looking over the brakes. If the safety valve is screaming with joy, it drowns all leaks, and the inspector will not hear them, be they ever so great. We will assume that you have started with a train of fifty cars, say from 25 to 50 per cent. of train air-braked. You are now running at full speed. It is necessary for you to slow down for a draw-bridge or a signal which is against you. Wait a little while after shutting the engine off for slack to run in. Do not draw off less than 5 pounds for the first reduction. You are now running less than eight miles per hour, and it is not necessary for you to stop. Which is best to do—come to a full stop or release brakes? My plan during the past two years in active service has been to put the brake valve handle in full release and leave it there for a few seconds. I have had good results, and have not broken a train in two in that time.

Some engineers release a thirty-car train the same as they would release the brake on a light engine. Discrimination must be used, and therein lies the secret of success. You will not overcharge the train line and auxiliaries as long as the black hand does not go above 70. Do not open the throttle for thirty to fifty seconds after releasing, according to the application you have made. The heavier the application, the longer you must wait. Good results have been had by using three or four retainers on cars next to engine to hold the train bunched. The chances are nine out of ten that you will break the train in two if you begin to use steam as soon as you release.

You have now come to a place where you must come to a full stop. The moment you stop, release the brake (if not on a heavy grade), for the rear end of train starts back on account of springs in draft rigging being compressed. You can see that for yourself when you release. The engine starts ahead. There will be quite a shock to the draft rigging behind the air if you leave the brake set. Do not open throttle at once. Wait at least twenty to thirty seconds for the train to adjust itself. Always remember that the men who ride in the caboose have rights and feelings as well as yourself. Ask them at the end of the division what kind of a stop you made at ——, where you thought you did well, and in a little while you will be surprised at yourself that you are doing such good braking with cars you never saw before. What would you do if you were like your brother passenger engineer, handling the same cars every day?

Ninety per cent. of damage to draft rigging and lading should be charged to switching and making up trains in the yard, and to some of the automatic couplers. It is something terrible the way some of the cars are slammed together to make the couplers lock. It is all put on the freight engineer and the air brakes.

These suggestions will probably not meet with the approval of all, but they may be the means of bringing out some good ideas on handling long freight trains with air brakes that would otherwise be a long time coming to light. "EASTERN."

Description of the New York Triple Valve.

Editor:

During the past two years a great many triple valves of the New York Air Brake Company's manufacture have been put into use on both passenger and freight equipment; and it is not an uncommon sight to see a few of them mixed in with others on a fully or partially equipped air-brake train.

To assist those readers who are of an inquiring turn of mind, and also to aid those who may have the care of this type of triple valve, to obtain the best results, I am sending you some sketches and a description of the valve.

The triple valve strainer is made in the form of a cone to prevent it from clogging up readily and to give more area of opening for the air to pass through.

The triple valve proper consists of the triple piston valve 128, the exhaust valve 38 and the graduating valve 48. The graduating and exhaust valves are of the slide-valve pattern, and in their arrangement on the triple piston stem are independent of each other. The triple piston valve is of the cup or extended pattern, and forms a cylinder for the vent valve piston 129. These three valves, combined, of course, constitute the triple valve, and the triple valve is the part that gives the brake its automatic action.

The quick-action part of the triple consists of the vent valve piston 129, the extended cup or cylinder of piston 128, vent valve 71, vent-valve spring 132, emergency piston 137, emergency valve 139 and brake cylinder check valve 117. To these parts we may add the vent ports *M* and *J* and the passages *H*, *L L* and *K*.

In charging up, the air comes in from the train pipe, takes the course indicated by the arrows in Fig. 1, and passes by the triple piston through the feed groove *B* to the auxiliary; it also charges chamber *G*, between the vent valve and triple pistons, through the very small port *F*, drilled through the vent valve piston.

In the service application (Fig. 2) only the triple valve proper operates. The triple piston moves to the left until it rests against, and forms an air-tight joint on, the leather gasket 133; then the exhaust valve 38 is moved into a position covering the exhaust ports from the brake cylinder to the atmosphere, and the service port is uncovered by the graduating valve 48, so that the auxiliary pressure may expand into the brake cylinder and apply the brake. To make the triple operate in the service

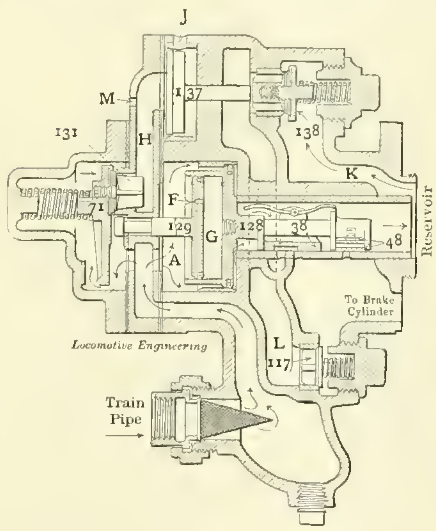


FIG. 1.

or graduated application, a gradual reduction in train pipe pressure is required.

The quick-action parts of the triple are to be operated only in emergencies, and are added to the triple for the purpose of giving a quick serial application of the brakes throughout a long train.

If a quick, serial application of the brake is desired, as in emergencies a quick reduction in train pipe pressure must be made, which will cause piston 128 to move very quickly to the left, and thus, by cushioning and compressing the air in chamber *G*, which does not, on account of this quick movement, have time to escape, moves vent valve piston 129 to the left, until its stem strikes against the lever arm of vent valve 71 and opens it, as in Fig. 3. [The engraving should show this valve 71 wide open and free from its seat.—Ed.] The pressure that surrounds vent valve 71, and with the assistance of spring 132, holds it to its seat, is train pipe pressure. The moment the vent valve is moved away from its seat train pipe pressure in a large volume escapes to passage *H*, and rushes

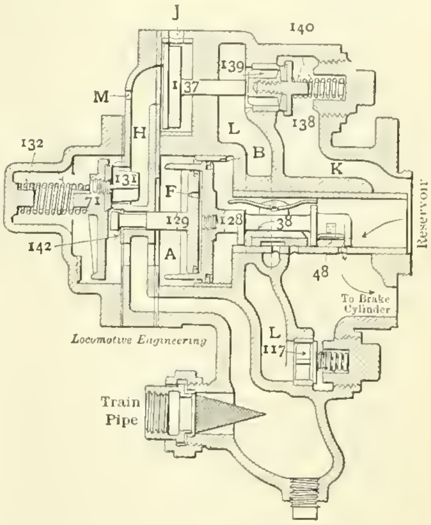


FIG. 2.

around the valve body until it strikes against piston 137, the emergency piston.

The stem of piston 137 passes through an opening drilled in the valve body, and reaches almost to the emergency valve 139. When the air vented from the train pipe into passage *H* reaches piston 137, it forces it quickly to the right and causes the stem to bear against valve 139 and force it away from the seat.

When valve 139 is moved back, away from its seat, the pressure behind it in passage *K*, which is auxiliary pressure, has a large, almost direct, opening into the brake cylinder through the passage *L L* and check valve 117.

After the vented train pipe air has performed its duty of moving piston 137 to the left, it escapes to the atmosphere through ports *M* and *J*.

This triple valve has no communication

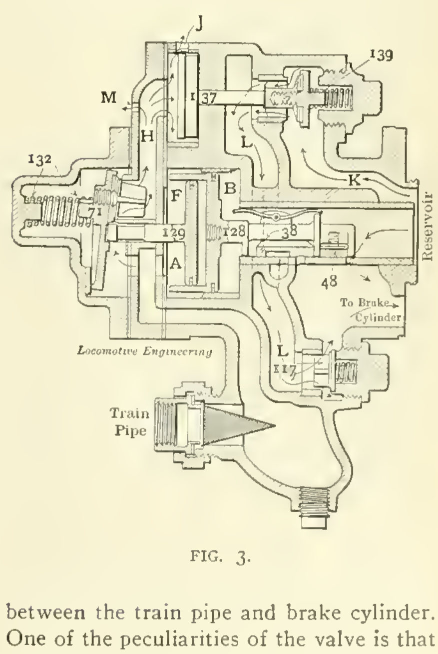


FIG. 3.

between the train pipe and brake cylinder. One of the peculiarities of the valve is that when the train pipe and auxiliary are charged, if anyone of the valves leaks, it can be detected from the outside and remedied without disturbing any of the pipe joints.

Fig. 1 shows the triple with all valves in their normal positions. Fig. 2 shows the position of the triple valve in the service application. Fig. 3 shows the triple in emergency application. The arrows indicate the course of the air escaping from the train pipe to the atmosphere, and also from the auxiliary to the brake cylinder.

J. P. KELLY.
A.-B. Insp., Chicago & Alton R. R.
Bloomington, Ill.

Two Application Stops.

Editor:

One or two applications, is a question that still remains open for discussion and approval, as the members of the Air-Brake Association did not give a final decision on that subject at their last meeting.

Through the kindness of the superintendent of motive power of the Michigan Central Railway I was accorded the privilege of riding on one of that company's engines. I rode a distance of 153 miles on the engine pulling the Boston, New York and Chicago special, and I cannot refrain from commenting on the skilful way that the engineer handled the brakes, thereby reducing the recoil to a minimum and retaining the passengers in an amiable frame of mind.

All stops were made with two applications. The total amount of the reductions during the first application was from 12 to 15 pounds. They were made some distance from his stopping point and while the train was at high speed. His release and second application were made when the speed of the train had been reduced sufficiently to enable him to make his second application with a braking power that was adequate, and proportional to the speed of the train. The engineer demonstrated, by his efficient method of handling the brakes, his practical and theoretical knowledge of the air brake.

J. J. FLEMING.
Proctor Knott, Minn.

To Avoid "Sticking" Brakes.

Editor:

As I am familiar with the Westinghouse and New York brakes, I would like you to publish the following, in regard to Mr. Thomas Caffrey's brake sticking, in April number.

I have had considerable experience along his line, and will say that I find it a good plan to keep the governor clean and sensitive, and the excess pressure valve clean and ground to a perfect joint; and in using sand, just open the sand valve a quarter of a turn. By so using the sand valve, this method will give more sand to the rail and not interfere with the brakes.

Carrying the valve handle in full release kills the excess pressure, and the main drum pressure and the train line pressure become equalized. Opening the sand valve full will allow the air from the train line to pass back into the main reservoir, thereby reducing tne train line pressure and setting the brakes. By carrying the handle in running position, you will have the full amount of excess in your main reservoir, and will not stick the brake by using the sand valve as above.

By carrying the handle of the New York brake valve in full release, you have no air in the supplementary reservoir, as there is a passage leading from it to the atmosphere, which allows the train line pressure to move the equalizing piston back to its normal position, thereby bringing the graduating valve to its position ready for the next application of the brake. In all cases this handle must be moved to full release after an application of the brake. This supplementary reservoir cannot be recharged, only in running position. The pressure in it is the same as the train line, and is only reduced after an application of the brakes, by the train line moving the piston forward, which will allow the graduating valve to cut off the flow of air from the train line.

ROBERT E. HANSON.
Birmingham, Ala.

The Semaphore Air Gage.

Editor:

I want to say a few things about the semaphore air gage, as I see considerable is now being said about it.

First—Put it up on the bracket so the hand when registering 50 and 90 pounds will point horizontal, and vertical when pointing at 70 pounds.

Second—Put it up with copper connecting pipes, then you will not have the twisting strain on the mechanisms that will make it register wrong. Iron pipe is hard to fit on so it will not produce these strains. Nine out of ten gages are put up with strains; but the old gage doesn't seem so badly out of register, as it has less sweep of hands, but is really just as bad.

Third—See that the hands are pressed on tight. They are more likely to work loose on the semaphore, as the greater sweep gives a greater momentum to the hands.

Fourth—Be sure that the segment in the gage is long enough, as the pinion can't slip back a cog when high pressures are carried. This will make it register 10 or 15 pounds light.

Fifth—Don't get sour on the semaphore when you find one out of register. How many of your old gages register within 5 or 8 pounds. The greater sweep does it. Read page 208, May LOCOMOTIVE ENGINEERING.

OTTO BEST,
Supt. Air Brakes, N. C. & St. L. Ry.
Nashville, Tenn.

The general interest being shown in the care and handling of brakes is an encouraging sign.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(62) H. M. A., Chicago, Ill., writes:

With a three-car passenger train, having brake piston travels of 6, 8 and 12 inches, respectively, what reduction would you make to get a fully applied brake, and what pressure would each brake equalize at? Please say how it is worked out. A.—See lengthy explanation elsewhere in this department.

(63) S. B. Y., St. Paul, Minn., asks:

Would you please say if there is a special tool made for removing and replacing hands on air and steam gages, and if so, where such a tool may be purchased? A.—We would suggest that you write any of the gage makers for the tool. These companies, we believe, manufacture the tool and have them for sale.

(64) F. J., Chanute, Kan., writes:

Suppose we have 70 pounds train pipe pressure, standard Westinghouse freight brake equipment; make an 8-pound reduction of train pipe air. How much pressure would you get in brake cylinder with a 7-inch travel? What I want to know is how you go to work to get the pressure in brake cylinder with different train line reductions and different piston travel. A.—See lengthy explanation elsewhere in this department.

(65) R. E. L., Roselle, N. J., writes:

Suppose on a train of ten cars equipped throughout with Westinghouse air brakes, five cars break loose from the train. Are the brakes set automatically on both sections of the parted train, or only on the five cars that break loose? A.—All ten brakes will set automatically on account of the air leaving the train pipe. For a moment, perhaps, the head brakes may be held off by air coming from the main reservoir through the brake valve, providing the handle be in full release position, but they will set. The brakes set automatically on both head and rear sections.

(66) T. H. B., Palmerston, Ont., writes:

In your answer to L. W., Xenia, O. (50), in May number of LOCOMOTIVE ENGINEERING, page 211, is there not a slight mistake? Does not equalizing reservoir pressure escape by groove P in the under side of the rotary and groove H on rotary seat, which were made longer in the '92 model than they were in the D-8 brake valve to allow this pressure to escape and the gage hand registering pressure to fall, showing that equalizing pressure and train line had been lowered? A.—You are right. Chamber D air is only held imprisoned in the D-8 valve, and is allowed to escape as you describe in the 1892 model.

(67) H. O. L., Easton, Pa., asks:

Why, when leakage grooves are used in ordinary cylinders, should they not be used now in driver brakes where there is a push piston? A.—Leakage grooves have been incorporated in all push driver brake cylinders of recent manufacture as well as in ordinary car brakes. This has been the practice several years, ever since an engine on a certain Eastern road had the driver brakes creep on and heat the tires so they moved in toward the frame, which they cut badly. These grooves in the driver brake cylinders were at first made the usual size and length, but have been recently reduced to about half the capacity and length.

(68) P. E. W., New York City, asks:

1. On page 125, March issue, you illustrate a train-pipe strainer and drain cup, and from the written article I infer that the strainer is made fast to nut 36. Am I right in this? A.—1. No; the strainer is free and separate from the nut 36, and is not connected to it. The strainer fits lengthwise in the casing, and is supported by the extended portion of the nut which projects into it. 2. From the cut it appears that the thread on nut 36 is straight (machine, not pipe thread) and that the flange of nut forms a ground joint. Am I right in this? A.—2. The thread is straight, or machine cut. The flange which rests on the outer side of the casing is a tight joint, but is not ground.

(69) J. L. B., Wellsville, O., asks:

1. Do you think, in case a freight train breaking in two, I could make, with a special piece of apparatus, a service application on the rear part of the train, and not affect the front of the train? A.—1. You could probably do it. There are already quite a number of patented devices on the market for doing this and kindred things; but they do not seem to be of sufficient importance to make them of any value in train service. 2. Do you think an apparatus of this kind would be of any account? A.—2. When a train breaks in two, both parts should be stopped as quickly as possible. For this reason, such a device as above mentioned would not be desirable nor meet with success.

(70) R. B. E., Bloomington, Ill., writes:

I had fifteen cars of air in train of twenty-two cars. Used the brake to stop to head into a siding. Pulled through siding and out on main line again. Sixteen miles from the siding I tried to stop, but didn't have air enough. It was about 35 minutes from the time I last used the air. I hadn't looked at my gage in that time. Leaving the siding I made a light application to slow up for the switch, and may have left my valve on lap. I don't know. Now, could the air leak out of the train in that time without letting me know it by brakes dragging? A.—Should your brake valve handle have been left on lap as you pulled away from the siding, there would be no air pass from the main reservoir to the train pipe and auxiliary reservoirs, and there would be no pressure in the train except that which was already there when you pulled away. In 35 minutes' time the air might leak from the train pipe, and from the auxiliary reservoir through the brake cylinder leakage grooves, if these grooves be clear. However, should some of the grooves be stopped up, those brakes would most likely set; but if the grooves were clear, it is altogether probable that the pressure would leak away without causing brakes to set.

(71) C. S. D., Sacramento, Cal., writes:

I would like to ask you to account for the strange action of air pumps on this particular engine. First, we know conclusively that the pump gets ample oil throughout, using the best valve oil. Second, all pipe work is properly fitted up and standard; that this is the only engine I've seen on which pumps act this way; that all pumps act the same; the life of a pump is about six weeks. This engine works night and day; does the passenger-car switching at the depot here. When putting on a pump every part is first class in every detail. When taken off, the air end is as good as on the day it left the shop, not even the tool marks in the cylinder being worn away; while in the steam end everything, main valve, main piston, reversing piston, reversing valve, etc., being practically useless—worn away very bad indeed. Why wear on just one end, and on the steam end at that? The packing rings in the steam end sometimes are about 3-64 inch thick. Kindly explain the cause, and oblige and instruct one of your constant readers. A.—We will assume that the oil which leaves the lubricator actually reaches the parts in the pump and doesn't leak away *en route* or feed back into the boiler. If the trouble is experienced with this engine alone and with all pumps put on the engine, the cause must lie with the engine or with the peculiar service of the engine. On a switching engine the surging of the water from the front end to the back end and *vice versa* is greater than on a road engine, and the tendency for wet steam and water to reach the pump is also greater. This tendency would be increased if the dry pipe to the steam turret or pump throttle were too short or poorly fitted up, thereby allowing water to go to the pump. The dry pipe may be perfect and yet water pass to the pump if the boiler foams or primes, or the engineer carries too high water. The cause of your trouble is probably something of this kind.

(72) J. H. R., Omaha, Neb., writes:

In answer to my question, No. 56 in May number, in regard to the action of the triple with the graduating valve removed, you say that sometimes service application will be had, but oftener emergency will result. Now, I can't understand how, by removing the graduating valve, that the triple valve will go to the emergency position, as the air can expand from the auxiliary into the brake cylinder just as fast with the graduating valve removed, as if it were in its place. As I understand the triple, if the reduction is made gradual from the train line to the atmosphere, the triple will move toward service position till the service port is opened between the auxiliary and brake cylinder. Now, the air in the auxiliary expands into the brake cylinder, thereby reducing the pressure in the auxiliary; and as soon as the pressure in the auxiliary is reduced to, or a trifle less than, that in the train pipe, then the triple moves toward release position. If the valve and piston move smoothly, they will stop on lap position; but if they jump, the triple is liable to go to release position. Now, will you kindly explain how the triple will go into emergency when making a service application or a service reduction from train line. A.—The error is ours. We should have said that with the graduating valve removed, and a light train pipe reduction, the piston and slide valve would go to service application position as usual. The piston and slide valve go to lap position, and then close the port between the auxiliary and brake cylinder. Sometimes the piston and slide valve will stay on lap position, but oftener it will go to release. Removing the graduating valve could not, of course, produce any tendency toward emergency application.

(73) J. J., Nashville, Tenn., writes:

I have frequently observed in examining and working on Westinghouse air pumps, especially the 9½-inch pump, that by tapping the top head very lightly when the piston is at the top end of the stroke, the tap would keep the pump in motion, when otherwise it would not move. This has occurred where main valve rings and reversing parts were apparently in good order, and again when these parts were the reverse, in both cases sufficient oil being given the pump. Now, the tap I refer to was so light that it would seem impossible for it to effect or jar the inner parts of the pump through the thick casting of the head. What I desire to learn is, what particular parts or part is so sensitive that it can be affected by such a light tap, governor or other parts being in good order. A.—It has doubtless been observed that all air pumps, as a rule, reverse more easily on the lower end of the stroke than the top end, and that the retarded reversal at the top end always occurs when the pump is running quite slowly, either due to light throttle or when governor is beginning to check the pump. At this point the motion of the pump is hindered greatest, because of the resistance of the air pressure in the air cylinder, the friction and the weight of the main piston. If running slowly, especially if the steam pressure be low and the air pressure high, the main piston will hang and tend to stop. In other words, the forces tending to resist the upward stroke of the piston are nearly or about equal to the steam pressure. The friction is a considerable factor. The light jar, however, changes the static friction of the main piston to sliding friction, which is much less, and therefore starts the pump moving. The jarring is just as effective on a thick piece of metal as on a thin piece. With comparatively high steam and low air pressure this hanging will not occur.

Instruction Car.

We present in this number some views of the interior arrangement of Instruction Car 103 of the International Correspondence Schools, showing how the car is designed to give good seating capacity for the class during the stereopticon lectures.

INSTRUCTING A CLASS.

One view shows the interior of the car looking towards the stereopticon, with the models and sectional valves arranged on each side of the car. The other view is taken over the heads of the class, looking towards the instructor. There is comfortable seat room for forty-five persons. On one occasion there were fifty-three in there. By this method all the students can see the pictures projected on the large screen at the end of the car, and the instructor can explain to a large class, something that cannot be done when sectional valves or models are used. A full set of lantern slides for one of these cars comprises about nine hundred separate pictures. In the case of the air-brake apparatus the valves are shown in each of the many different positions they may be in during their operations.

In the view of the group outside the car is the class of young men now being examined for promotion to engineers on the Chicago & Northwestern Railway at the main shops at Chicago, the traveling engineers in charge of the examination and their air-brake instructor, together with the force of instructors employed on the car.

The Ferracute Machine Company, of Bridgeton, N. J., have three exhibits of presses, dies and other sheet-metal machinery at the Paris Exposition. One of their large presses is so constructed as to relieve the frame from stresses.

The Story of the Steam Engine.

FIRST PAPER.

The history of the steam engine is a materialist romance that has had no parallel in the records of human achievements since the world began. We can conceive of no intelligent person who would fail to read with pleasure the story of the men whose stupendous labors brought into practical form the most potent forces of nature that have ever been subdued for the use and comfort of the human race. The reflective man must view with admiration the persistent work of philosophers and mechanics who found steam as a mysterious uncontrollable agency, and reduced it to ordinary comprehension and utilitarian control.

The steam engine represents the most successful invention ever brought into use for converting the potential energy of coal or other fuels into mechanical work. It is not the most economical prime motor in use; but it possesses practical advantages over all other forms of heat engines that are likely to protract its existence for a long time to come.

The development of the steam engine has been a matter of slow growth, built up to a great extent on the ruins of expensive mistakes. What is now considered civilization was no doubt in its infancy when people began to find out that holding down the lid of a boiling caldron was liable to end in disaster to the cooking utensil. When accidents to the principal cooking vessel of the household first began to be noticed through the laudable efforts of the thrifty housewife to hold in the savory fumes, diabolical agencies were supposed to have caused the explosion. Diabolic agencies were long a convenient means of explaining things that were not easily understood, and some people still cling to that way of mystifying others about the action of forces they do not comprehend.

In the world there are always some men who see farther into so-called mysteries than their neighbors. It is a long time since philosophers—searchers after truth—began to assert that the vapor from boiling water, which played havoc with the kailpot, was a natural force whose power might at some time be utilized for useful purposes. Thus speculation about steam began. Its roots were for centuries no farther spreading than those from a grain of mustard seed, but they were alive and strong with potentialities.

INTERIOR OF CAR, LOOKING TOWARD STEREOPTICON.

There is no means of knowing how long ago people began trying to use, in different ways, the force obtained from the expansion of steam; but it is certain that a crude form of steam engine was exhibited as a curiosity in Alexandria, in Egypt, two hundred years before our era began. There is good reason for believing that the philosophers of those days had made some progress in using the pressure of steam for mechanical purposes. The leaders of the intellectual world in ancient times were, however, much more given to theorizing about discoveries than to applying them to the service of their fellowmen. In fact, they would have considered it degrading to use their inventions or discoveries to lighten the burdens carried by mankind.

The ancient Saxons appear to have been familiar with the principal elements that are used in a steam engine, but they never understood the combinations necessary to chain them into a working machine. And the spirit of utility was not sufficiently active to induce them to labor on solving the problem. Later on evil times fell upon the world, and the use of the sword almost annihilated the use of the pen.

From the time the Christian era began until about three centuries ago there were very few scientific men, and the few that existed had other things to do that seemed more important than working out a new motive power. But as war became less and less the principal avocation of mankind, leading minds began to devote their attention to plans for putting the potential forces of nature to useful purposes. The urgent necessity for draining water out of deep mines was the impetus which brought forth the steam engine. Great properties in Great Britain were going to ruin because engineers had been unable to concentrate sufficient animal power to raising water from great depths.

For several centuries various philosophers and experimenters tried to raise water by the use of steam, but they were all on the wrong line of experiment. They discovered that by filling a vessel with steam and then condensing it, a vacuum was formed which would suck up water a distance of about 34 feet. A series of these lifts was sometimes used to raise water for a considerable distance. Another plan was, to apply the steam directly to the surface of the water, as compressed air is now employed at many places for raising oil and for raising water in sleeping cars. Both these methods were crude and the waste of heat was enormous, but they were better than animal power.

A revolutionary advance over these methods was made about 1705 by Thomas Newcomen, an English blacksmith, who applied a piston to a cylinder. A steam-tight piston working in a cylinder constitutes the most important element of the steam engine. Before Newcomen's time several philosophers had proposed using a piston, but they were not able to devise the mechanical arrangements necessary to transmit the power from the piston. Newcomen built an engine with a cylinder and piston, and connected the latter with a walking beam which had a pump rod connection at the other end. As the art of boiler making was then almost unknown, Newcomen used steam of little more than atmospheric pressure, and employed it to fill the cylinder for the purpose of creating a vacuum by the use of water. A counterweight brought the piston to the top of the cylinder, the part below the piston was then filled with steam, cold water was applied to the outside of the cylinder and piston and the steam was condensed, when the pressure of the atmosphere pushed down the piston, performing a stroke. The strokes originally were not more than four or five a minute. Newcomen's invention is known to history as the "atmospheric engine."

The first radical improvement effected on this engine was suggested by accident. The piston was kept as nearly steam tight as possible, and a charge of water was applied on the outside to help in condensing the steam inside. One day it was noticed that the engine began working more rapidly than it had ever done before. On investigating the cause Newcomen found a hole in the piston packing, which permitted the condensing water to enter the cylinder, where it did its work more rapidly and effectually than when it had to do the cooling through the walls of the cylinder. After that a jet of water was injected inside the cylinder, which materially increased the efficiency of the engine.

The motion of these atmospheric engines was so slow that the inventor did not consider it necessary to devise any automatic mechanism for operating the valves that admitted steam and water to the cylinder. A boy was employed for opening and closing the valves at the proper times. A boy named Humphrey Potter was valve turner at one of these engines, and he wanted some time for play while at work. Being an ingenious lad, he devised an arrangement of cords which was operated by the walking beam and opened and closed the valves automatically. This simple arrangement nearly doubled the strokes made by the engine. In this humble way originated the automatic valve motion.

When, after a persistent struggle, Newcomen demonstrated that his engine could be depended upon to pump water out of deep mines, and that the expense was much lower than that of animal power, there were plenty of men ready to interest themselves in working out improvements on the engine. The principal improvements made on the Newcomen engine were carried out by Henry Beighton and John Smeaton, both famous engineers of their time. Beighton devoted himself principally to making convenient and substantial attachments and mechanism; Smeaton worked to secure greater efficiency for the

INSTRUCTION CAR OF THE INTERNATIONAL CORRESPONDENCE SCHOOLS.

heat expended in operating the engine. Their labors produced an engine that was fairly efficient, so that within seventy years it attained decided popularity in all countries where the pumping of water had to be done on a large scale. By the year 1780 there were over one hundred Newcomen engines at work in Great Britain, ranging in capacity from 15 to 150 horsepower. Many of them had been sent to different countries on the Continent of Europe and a few to the United States.

The weak feature about the Newcomen engine was the great waste of heat caused by cooling the cylinder each stroke for the purpose of creating the vacuum. To remedy this source of waste became the purpose of several engineers and inventors. The most celebrated among the men was James Watt, a mathematical instrument maker, of Glasgow, Scotland, who is generally credited with being the inventor of the steam engine, which is giving him more honor than he deserved.

Watt, who was naturally an inventor and had received a fairly good mechanical training, had a working model of a Newcomen engine in Glasgow University, sent to him to be repaired, and he obtained permission to experiment with it. He had previously made some progress in the study of natural philosophy, and he applied this knowledge to investigating the phenomena of heat producing power through the medium of steam. The discoveries that resulted were in themselves sufficient to make Watt famous.

At that time very little was known about heat, and less about steam. In his experiments with the Newcomen model Watt found out:

1. The capacities for heat of iron, copper and of some kinds of wood as compared with water.

2. The volume of steam as compared with water.

3. The quantity of water evaporated in a certain boiler by one pound of coal.

4. The elasticities of steam at various temperatures greater than that of boiling water, and an approximation to the law which it follows at other temperatures.

5. How much water in the form of steam was required every stroke by a small Newcomen engine, with a wooden cylinder 6x12 inches.

6. The quantity of cold water required in every stroke to condense the steam in that cylinder, so as to give it a working power of about 7 pounds to the square inch.

All the engineers of reflective minds who had interested themselves in the Newcomen engine saw that using the cylinder as a condenser caused a serious waste of heat; but Watt determined with exactness what the loss amounted to. It might have been supposed that Watt, having become acquainted with the elastic properties of steam, would have abandoned the condensing feature and made an engine to work by the direct action of steam, but he appeared to cherish a strong antipathy to high pressure steam, principally because when he began building engines no boilers had been made that could safely resist a pressure of more than 20 pounds above the atmosphere. Savery, one of the early experimenters in raising water by the direct action of steam, had several disastrous boiler explosions, which made many people distrustful of steam pressed above one atmosphere.

Watt was a great believer in utilizing the pressure of the atmosphere with a condensing engine. After cogitating a long time on how to overcome the defects of the Newcomen engine, he conceived the idea of using a separate vessel as a condenser. This resulted in a great saving of heat, and Watt's engine rose rapidly into favor, especially for districts where fuel was expensive.

The worldly success of Watt in the introduction of the steam engine was greatly aided by his good fortune in entering into partnership with Matthew Boulton, an excellent business man, possessed of the means necessary for developing the new industry of engine building. Many an accomplished inventor who has descended to an obscure grave would have risen to fame and opulence if he had only succeeded in finding a Boulton to manage his business.

For years Boulton & Watt devoted themselves to building pumping engines exclusively, and at first they were all single-acting, operating nearly in the same way as Newcomen's atmospheric engine was worked, the most radical difference being that the steam was condensed in a separate vessel, and extraordinary efforts were made to keep the cylinder as hot as the incoming steam. In the course of improvement, Watt came to use steam in both ends of the cylinder, and he perfected the details of the engine, so that it was suitable as a motive power for all industrial purposes except land locomotion.

Soon after the pumping engine was perfected sufficiently to work without difficulty or failure, a demand arose for the steam engine to be applied to the production of rotary motion for manufacturing purposes. Watt proposed a variety of ingenious expedients for the production of rotary motion, and proceeded to build engines with an arrangement he called "sun and planet" wheels. The crank shaft carried a gear wheel which engaged with another secured to the end of the connecting rod, and attachments were applied which kept these gears in mesh, with the result that rotary motion was produced. That was afterwards abandoned for connection with a crank, a method of producing rotary motion as old as the grindstone. Why that simple expedient was not covered in Watt's early patents is an omission not easily understood. Its use was patented by another inventor, and Boulton & Watt had to pay royalty for permission to use it.

Among Watt's inventions were: The separate condenser; the using of steam expansively; applying steam to both sides of the piston; the steam hammer; a parallel motion for grinding the piston rod and an alternation of crosshead and guides; the puppet valve with beveled seat; the steam engine governor; the steam engine indicator; the mercury steam gage, and a great many other devices of decided mechanical merit.

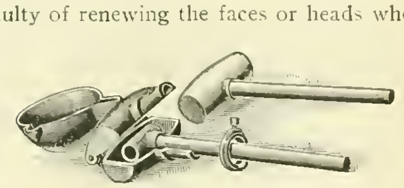
Watt lived to see his steam engine revolutionizing the industries of the world. It had drained mines and given employment to thousands of people that were previously in destitution; its operation had turned thousands of acres of marshes into arable land, greatly increasing the food supply of his country; it was turning the wheels of thousands of factories; it was developing the rich mineral resources of the British Isles and bringing plenty where penury had previously reigned. Watt lived to a good old age, and on his death received honors from the nation such as never before had been accorded to any follower of industrial pursuits. His fate was very different from that of Thomas Newcomen, whose grave even is like that of Moses, unknown and unnoticed.

Nearly all Watt's engines had the cylinders set vertically. The influence of this arrangement extended itself for years to all lines of engine building, and it is seen in all the locomotives built in England up to the time of the competition for locomotives to operate the Liverpool & Manchester Railway, in 1829.

Of other improvers of the steam engine and their work, we will give particulars in succeeding papers.

A New Lead Hammer.

Soft hammers—as they are called, except when they smash our fingers—are not often entirely satisfactory, owing to difficulty of renewing the faces or heads when



FIELD'S SOFT HAMMER.

worn out. In the engraving shown, the inventor seems to have devised a good method, which is also very cheap. The hammer itself—or stock—seems to consist of a tee on the end of a pipe. This is placed in a mold, which is clamped on and the lead poured in. When worn out, the lead is melted out and a new head cast on. These are for sale by Charles H. Field. Chestnut street, Providence, R. I.

The Bethlehem Steel Company have moved their Cleveland office to No. 312 Perry-Payne Building, and their St. Louis office to No. 502 North Second street.

Personal Department.

Mr. O. G. Cheatham has been appointed general foreman of the Georgia & Alabama shops at Savannah, Ga.

Mr. H. J. Buck has been appointed division superintendent of the Chicago & Eastern Illinois at Marion, Ill.

Mr. Geo. A. Rice has been appointed assistant division superintendent of the Boston & Albany at Springfield, Mass.

Mr. R. H. Soule has opened an office at 71 Broadway, New York, as consulting and designing mechanical engineer.

Mr. E. S. Spencer has been appointed general superintendent of the Jacksonville & Southwestern at Jacksonville, Fla.

Mr. John Reed has been appointed machine shop foreman of the Delaware, Lackawanna & Western at Scranton, Pa.

Mr. H. E. Hoffman has been appointed engine inspector for the Wisconsin Central Railroad, with headquarters at Waukesha.

Mr. Wm. Miller has been appointed master car builder of the Erie & Wyoming at Dunsmore, Pa., vice Mr. S. D. King, resigned.

Mr. John Dixey has been appointed master car builder of the Ohio Southern at Springfield, Ohio, vice Mr. Wm. Madison, resigned.

Mr. L. W. Lawton has been appointed general superintendent of the East Tennessee & Western North Carolina at Cranberry, N. C.

Mr. J. D. Cutteridge has been appointed trainmaster of the Galena division of the Chicago & Northwestern, vice Mr. H. A. Battisfore, resigned.

Mr. Wm. Bliefield, a machinist in Grand Rapids roundhouse, has been promoted to roundhouse foreman at Ionia, on the Pere Marquette Railroad.

Mr. T. O'Brien has succeeded Mr. E. F. Lundholm as master mechanic of the Pacific Coast Railway, with headquarters at San Luis Obispo, Cal.

Mr. C. T. Cooper has been promoted from the position of machinist to general foreman of the Toledo & Ohio Central shops at Kenton, Ohio.

The office of Mr. E. G. Russell, general superintendent of the Delaware, Lackawanna & Western, has been removed from New York to Scranton, Pa.

The office of Mr. Chas. P. Coleman, purchasing agent of the Lehigh Valley, has been removed from Philadelphia to 39 Cortlandt street, New York.

Mr. E. W. Tucker, formerly a machinist for the Pere Marquette at Ionia, has been promoted to the position of general foreman at Traverse City, Mich.

Mr. F. C. Cronk has been appointed engine despatcher on the Lake Shore & Michigan Southern Railway at Elkhart, Ind., vice H. R. Doty, resigned.

Mr. Fred Miller has been promoted from the ranks of passenger conductor to that of train master of the Chicago, Burlington & Quincy at Minneapolis, Minn.

Mr. N. J. O'Neil has been appointed assistant to the general foreman of the Plant System, vice Mr. C. S. Parks, resigned; office at Savannah, Ga.

Mr. H. R. Doty has resigned the position of engine despatcher at Elkhart, Ind., on the Lake Shore & Michigan Southern Railway, on account of ill health.

Mr. E. F. Essick, general foreman at Muskegon, has been transferred to the Saginaw shop of the Pere Marquette Railroad as foreman of the machine shop.

Mr. E. H. Barnes has been appointed general superintendent of the Atlantic, Valdosta & Western at Jacksonville, Fla., succeeding Mr. J. B. Cutter, resigned.

Mr. H. M. Taylor has been promoted from the position of trainmaster to superintendent of the middle division, with headquarters at San Luis Potosi, Mex.

Mr. W. D. Lowery has been appointed general foreman, car department, of the Missouri Pacific, succeeding Mr. Thomas Enbank; headquarters at St. Louis, Mo.

Mr. C. M. Mendenhall, superintendent of the Philadelphia, Wilmington & Baltimore, has been appointed superintendent of motive power of the Chicago & Alton.

Mr. S. A. Chamberlin, roundhouse foreman at Ionia, has been transferred to Muskegon as general foreman of the Pere Marquette machine shop and roundhouse.

Mr. L. B. Rhodes, in addition to his duties as master mechanic of the Georgia Southern & Florida, will also have charge of the car department; office at Macon, Ga.

Mr. J. E. Taussig, superintendent of the Wheeling Bridge & Terminal, has been appointed assistant general manager of the Wheeling & Lake Erie at Cleveland, Ohio.

Mr. E. M. Hedley has resigned his position with the Dickson Locomotive Works to become general foreman of the New York Central shops at Depew, N. Y.

Mr. D. Witherspoon, general foreman of the Baltimore & Ohio shops at Cumberland, Md., has resigned, and will accept a position with one of the Southern roads.

Mr. A. P. Prendergast, roundhouse foreman on the Baltimore & Ohio at Cumberland, Md., has been promoted to the position of general foreman at Benwood, W. Va.

Mr. Paul Synnestvedt, the well-known mechanical expert and patent attorney, has removed his office from 1234 Monadnock Block to 518-519 Monadnock Block, Chicago, Ill.

Mr. Edward Grafstrom, mechanical engineer of the Illinois Central, has resigned to accept a similar position with the Atchison, Topeka & Santa Fé at Topeka, Kan.

We regret to learn through our club raiser, Mr. L. Petrie, of the death last month of H. D. Roberts, master mechanic of the Oahu Railway and Land Company, Honolulu.

Mr. Alex. Kearney, assistant engineer of motive power of the Pennsylvania, has been appointed master mechanic of the West Philadelphia shops, succeeding Mr. R. W. Durborow, resigned.

Mr. J. E. Irwin, foreman of the Kenton shops of the Toledo & Ohio Central, has been promoted to the position of general foreman of the Columbus shops, succeeding Mr. J. E. Gould, resigned.

Mr. M. T. Conlon has been appointed master mechanic of the Charleston and Columbia divisions of the Southern, succeeding Mr. James Meehan, resigned; headquarters at Charleston, S. C.

Mr. J. E. Gould, general foreman of the Columbus shops of the Toledo & Ohio Central, has resigned to become master mechanic of the Cincinnati, New Orleans & Texas Pacific at Chattanooga, Tenn.

Mr. G. C. Bishop, assistant master mechanic of the Pennsylvania at Altoona, Pa., has been appointed assistant superintendent of motive power of the northwestern system of the Pennsylvania at Fort Wayne, Ind.

Mr. F. H. Scheffer, general foreman of the Nashville, Chattanooga & St. Louis, has been promoted to the position of superintendent of machinery, vice James Cullen, deceased; headquarters at Nashville, Tenn.

Mr. C. A. Ralston, superintendent of the Dayton, Lebanon & Cincinnati at Lebanon, Ohio, has resigned to accept service with the Isaac Joseph Iron Company at Chicago, Ill. He will have charge of their rail and equipment departments.

Mr. C. E. Houghton, lately traveling engineer and then general foreman at Toledo, Ohio., for the Lake Shore & Michigan Southern Railway, has resigned and entered the service of the Lunkenheimer Company, at Cincinnati, O.

Mr. C. J. Thompson, general foreman of locomotive and car department of the Western New York & Pennsylvania at New Castle, Pa., has resigned to accept position of general yard master of the Pittsburgh & Lake Erie at New Castle.

Augustus Large, one of the first locomotive engineers of the Pennsylvania Railroad, died recently at Belvidere, N. J., aged sixty-five years. He had been in the employ of the company nearly fifty years, and ran one of the first engines on the Belvidere division.

Mr. John W. Dalmon, general foreman of the Lehigh Valley shops at Buffalo, N. Y., has resigned to accept a position with the Pennsylvania. On his last day at the shops the shop and road men presented him with a handsome diamond ring as an expression of their good will.

Mr. J. S. Bander, lately general foreman at the Collingwood shop of the Lake Shore & Michigan Southern Railway, is now traveling engineer, with headquarters at Cleveland. Mr. C. H. Stalker, who was traveling engineer on the Erie division, has been assigned to other duties.

Mr. R. N. Durborow, master mechanic of the Pennsylvania at West Philadelphia, has resigned to accept the position of superintendent of motive power of the Philadelphia, Wilmington & Baltimore, vice Mr. C. M. Mendenhall, resigned; headquarters at Philadelphia, Pa.

Mr. A. A. Bradeen has resigned the position of master mechanic at Cleveland, Ohio, for the Lake Shore & Michigan Southern Railway. He has been succeeded by Mr. S. E. Dickerson, of Norwalk, whose jurisdiction has been extended, so he now has charge from Toledo to Buffalo.

The following notice has been issued by the mechanical department of the Santa Fé Pacific: The jurisdiction of Mr. C. F. Lape, division master mechanic; Mr. J. W. Records, division foreman, and Mr. James Grey, road foreman of engines, has been extended over the Seventh district, from Mojave to the East or South switch, Bakersfield yard.

Mr. George W. Adams, who has been on the Boston & Albany road for about twenty-eight years, has gone to the Hawaiian Islands to become superintendent of the railways of the Hawaiian Commercial and Sugar Company. They have 60 miles of railway on their own plantations, and rails for 30 miles additional are now under way. His address is Sprecklesville, Mani, H. I.

Mr. W. C. Walsh, foreman of the Louisville & Nashville roundhouse at Howell, Ind., has resigned to accept the position of general foreman of the Plant System shops at Montgomery, Ala. Mr. Walsh was held in the highest esteem by all on the Louisville & Nashville system, and was presented with a beautiful diamond pin by the men under his charge.

The following changes have been made on the Louisville & Nashville: Mr. E. E. Gerrett, foreman of the erecting department under Mr. E. J. Young, foreman of the machine shop, succeeds Mr. W. C. Walsh as foreman of the roundhouse at Howell, Ind. Mr. J. Bannon, foreman of the rod and link gang, transferred to foreman of the erecting department, assistant to Mr. E. C. Young, foreman of machine shop. Mr. W. H. Young, having charge of air-brake room, transferred to foreman of rod and link gang, Mr. Walter Gerrett taking charge of the air-brake room.

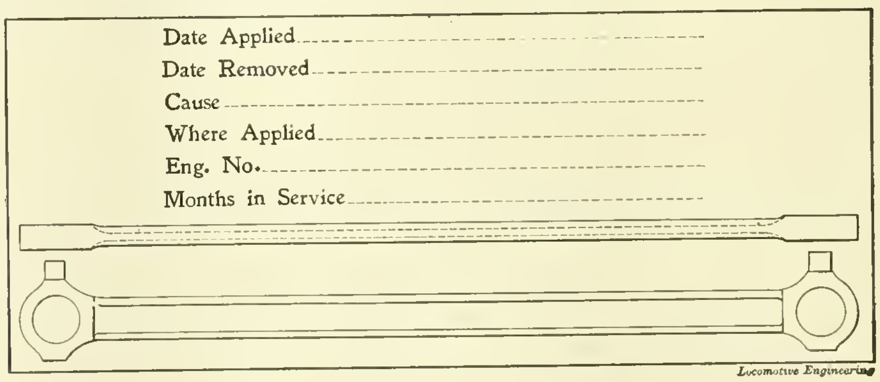
Mr. E. C. Bates has severed his twelve-year connection with the Crosby Steam Gage & Valve Company, and is now Eastern manager for the Ewald Iron Company, of St. Louis, Mo., with headquarters in New York. Mr. Bates has been so long with the Crosby Company and so active on the entertainment committees at the conventions, that many of his friends may not realize the practical experience he has had. After graduating from the Massachusetts Institute of Technology, he served his apprenticeship at the works of William Mason, in Taunton, Mass. Then through the intimacy of his father and Oliver Ames, he commenced firing on the Union Pacific Railroad, under J. H. Congdon, who was general master mechanic. Later he was sent to Chicago by T. E. Sickels as inspector of the caissons then being cast at Boomers old foundry in Chicago, for the bridge at Omaha. He was also in charge of the first artesian wells sunk by this road in the Bitter Creek country. On returning to Boston, he was superintendent of the Union Electric Signal Company, which was afterwards bought by Westinghouse, and he has always been connected with mechanical lines of work.

Ticket scalpers in various parts of the country having been found with counterfeit dating stamps, autograph stamps, etc., which enable them to manipulate tickets of the railroads, it has been found necessary to offer a reward for information resulting in the arrest and conviction of any person or persons fraudulently using such stamps or dies or imitations thereof. Mr. Geo. H. Daniels, general passenger agent of the New York Central, has issued the following circular: "The undersigned having been authorized by the railroads comprising the Central Passenger Association to act as a joint agent to validate for passage return portions of excursion tickets which will be sold at reduced rates for a number of important conventions to be held in Chicago, Cincinnati, St. Louis and other cities at intervals from May 1 to September 30, 1900, involving the use of autograph stamps, ticket-dating dies, etc., will pay a reward of five hundred dollars ($500) for information resulting in the arrest and conviction of any person or persons fraudulently using such stamps or dies or imitations thereof. Special notice to engravers and stamp makers: Orders have been placed for all stamps and dies required by the undersigned or his employés for the purposes above referred to. Therefore, any orders which you may receive purporting to emanate from the undersigned or his representatives for stamps or dies bearing the name of the Central Passenger Association or of F. C. Donald, will manifestly be given for the purpose of perpetrating a fraud on the railway companies."

A Defect Card.

There is a system in vogue at the West Albany shops of the New York Central road for keeping tab on weak points in construction which has good points of its own. The cards are really blueprints, about 3 x 7 inches, with various parts of an engine on them and the lettering as shown in the cut.

These blanks are kept in the foreman's office and filled out by his clerk. The weak spot or point of breakage is marked on the cut of the article itself, and they help in determining the points to be strengthened —or watched.



DEFECT CARD OF NEW YORK CENTRAL RAILROAD.

The Bethlehem Steel Company have recently taken an order for crank-shaft forgings for an important contract in Australia, the purchase having been made by a representative of the engineers who visited the United States in connection with the work. They have also supplied a hollow-forged steel shaft to replace the wrought-iron shaft which broke recently on the steamer "Puritan," of the New York, New Haven & Hartford Company's service.

The Rocky Mountain Railway Club was organized April 25th at Denver, Colo. The officers are. J. H. Manning, president; C. H. Quereau, first vice-president; W. E. Fowler, second vice-president, and Frank Harris, treasurer.

New Methods of Instruction.

Anyone who really wishes to learn can study, but all cannot get equal benefits from this study. No matter how hard they may try to learn from the printed lesson or text book, there are some students who do not know just how to attack a knotty problem to ensure a prompt solution. A very little help at the right time will give such students such a start that they can rely on their own talent thereafter. If a student has a teacher to explain and instruct from day to day, the lesson he is at work at is much easier learned.

Recognizing this fact, the Railway Department of the International Correspondence Schools has started competent instructors who go over the railroads on which students have been enrolled by the instruction cars. These instructors are to look up the students who are backward in their work, and give them such help and explanations as are needed to enable them to answer the question papers, and thus show that they understand the subjects treated of in the lessons.

This is the correct move; it will give the backward students help at the right time. It will also encourage those who have given up the hope of learning by the correspondence method, so that they will go ahead and finally finish the course successfully with a high percentage.

Any knowledge requires an effort to acquire. If we rely on ourselves only and have no outside help, we are apt to put off the effort to a more convenient season, which is always too late. Traveling instructors will increase the interest taken by the students, and tend to increase the number who finish the course.

The value of a school is measured more by the number who graduate with honors, than by the number in attendance.

Air-Brake Chart.

Some months ago the International Correspondence Schools sent out an air-brake chart 20 inches long by 9 inches wide, showing the engine and tender equipment, with all the parts arranged in their proper position, but no pipe connections being shown. A request headed the chart, "Pipe this for us." These charts have attracted considerable attention, and likely have caused a good deal of study as to the manner in which the respective pipes which conduct the air from one part of the equipment to another should be arranged. Where the engines are piped properly it is very little trouble to fill out these charts, but where they are not it is different.

These charts are coming back to the office by every mail, usually piped properly, which shows that it is a subject of interest.

Another chart on another matter connected with the air brake will be issued shortly. Chart No. 1 can be obtained, free of charge, at 1005 Manhattan Building, Chicago, Ill.

Profitable Philanthropy.

Anyone interested in the relations existing between capital and labor, no matter which side of the question he may be on, should visit the works of the National Cash Register Company, at Dayton, Ohio. Unless the visitor is a decided pessimist, he is sure to be impressed with the beauty of the surroundings, the bountiful use of flowering plants, which, by the way, are not expensive, and, above all, by the high class of the employès at work, both men and women.

There are club rooms, eating rooms, and other attractions, including lectures and entertainments, all of which go to make men contented, while prizes are awarded every six months for the best suggestions toward improving the machine or the making of it.

Business men are apt to wonder where the money comes from to do these things, and to think that they would like to do the same, perhaps, if they could afford it. This is made all the more interesting when we learn that the owners find that it pays in actual dollars and cents, aside from the contentment of the employés and the natural advertising that results. The increased production from the men and women pays a good profit on the cost of the many attractions named, so that the apparent expense is really a paying investment.

The plan is to set aside a certain percentage of the profits each year for this kind of investment, and the amount per person is not large—perhaps $40 a year. This is invested in various ways for the advantage of the employés, their children and the children of the neighborhood.

All this may sound rather faddish to those who have not seen the results, but these very things interest the neighborhood, whether employed or not, and have made it possible to remove fences from the grounds to give the children full swing on the lawns and to improve this part of the city immensely.

Some will claim that it savors of paternalism, and that the $40 should go to the individual. But the results show that much more good is accomplished than would be done in any other way, and as long as the paternal influence is in such good hands we have little cause to complain.

Add to this the fact that wages are the highest in the city, and almost anyone will admit that in this case at least it works splendidly for all concerned. While the scheme as a whole may not be generally applicable, a careful study will show some points can be utilized.

Some More Large Cars.

President Hill, of the Great Northern Railroad, is quoted as saying that he is getting ready to do a heavy freight business direct to Japan by steamship and rail line; that he is going to have the largest and fastest steamers for both the ocean service and the lake service, and the largest type of freight cars. This, of course, will call for very heavy engines, too; for the operating department of the railroad part of the line will insist on handling just as many cars in a train as they ever did. These very large cars cannot go into interchange service profitably. This will likely hold these cars on their home road, where they can be kept in the special service in which they are profitable. When this line of very large cars gets well started in this merchandise service it can be soon settled whether they are any more profitable than the standard box car of 60,000 pounds capacity.

ADMIRAL DEWEY'S SPECIAL TRAIN—PRESIDENT COWEN'S CAR.

The Big Four people are building, in their shops at Brightwood, Ind., 200 furniture cars that are the largest freight cars we have ever seen. The bodies of the cars are 50 feet long inside, 50 feet 9⅝ inches over sills, 8 feet 10 inches wide and 9 feet 4 inches high. The side and four center sills are 9 x 5 inches, and four truss rods are used, each 1¼ inches diameter.

Brotherhood of Locomotive Engineers' Convention.

This body of representative locomotive engineers met in Milwaukee on May 9th to hold the biennial session for revision of any of the laws which has been found necessary, to attend to any new legislation and elect officers to fill the places of those whose terms are now expiring.

There are 559 divisions on the list. Some of them are represented by the delegates from other divisions, but there are close to 500 delegates in attendance. This makes so large a body that the legislation is necessarily slow. Several plans have been proposed to reduce the number, but the desire of so many of the divisions to retain an independent membership in the Grand division has so far prevented any change in the plan of representation. The people of Milwaukee have extended them the glad hand. The Deutscher Club, one of the best clubs in the West, gave them a fine reception on May 9th, which has been followed by theater parties, trolley rides, excursions, etc., at close intervals during the session. On May 17th a ball was given in the Exposition building, with an immense crowd in attendance.

The Brotherhood kept up its record for church-going by attending various churches on the different Sundays they were in Milwaukee, in a body.

As the proceedings were secret, of course we cannot make them public here, but a great many of the subjects discussed are in the line of the elevation of the engineers to as high a grade of morals and mechanical ability as is possible. They recognize the fact that the public appreciates ability and respects it, and to hold that respect is their aim. By the time this reaches our readers the convention will likely have finished its labors and adjourned.

Curious Wrecks.

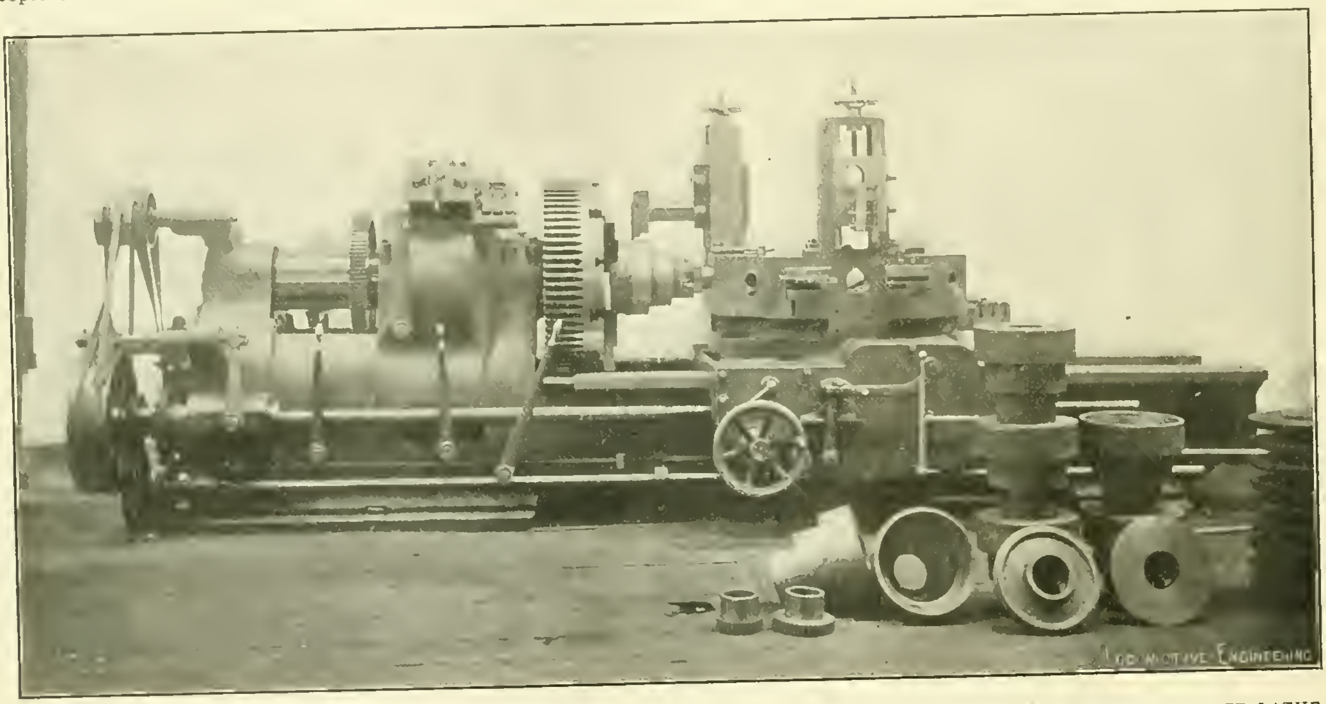
A recent news despatch says: "A wreck occurred on the Central Railroad of New Jersey near North Branch station this morning, which completely blocked the road between Easton and Somerville for seven hours. A gravel train standing on the eastbound track sent out a brakeman to flag a mixed freight and coal train drawn by engine 401 and running on the same track. The train stopped suddenly on a down grade and broke in two. A coal car was thrown on the westbound track just as a freight train drawn by engine 341 was passing. The engine crashed into the derailed car and was thrown over on its side. The engineer and fireman jumped and escaped with slight injuries. Fifteen cars were piled up and badly wrecked."

The Central Railroad of New Jersey has had several wrecks of this kind where an accident on one track blocked the other and was run into before the track could be protected. It is a very unusual accident, and it is strange that it should repeatedly happen on one railroad.

Vibration Promoting the Efficiency of Boilers.

Those who circulate engineering fallacies and falsehoods will always have followers if their statements are positively made. We have been strongly impressed with this since a statement was made in the New York Railroad Club, some time ago, that a locomotive boiler used in stationary service would not generate nearly the same amount of steam that it would running on wheels. We feel humiliated that we took the statement as a fact that had been verified and proceeded to theorize on what could be the cause of a boiler steaming more freely when jolting over a track than it did when resting on a solid foundation. The only explanation we could think of was that the vibration received by a boiler in motion improved the circulation and kept solid water upon the heating surfaces, whereas with a boiler at rest the water might be mixed with steam that passed away sluggishly. This seemed to be a very satisfactory means for explaining the matter, and we had just decided that no more light need be called for on that question, when we discovered that there is no difference between the steaming qualities of a boiler at rest and one in motion. The discovery spoiled a very pretty piece of theorizing, but the interests of truth compel us to make the confession.

It might have led to curious developments, had the statement proved true, that a boiler getting jolted steamed more freely than one at rest. People would say, if a little jolting is a good thing for promoting steam-making, hard jolting would be proportionally better. Then they would have proceeded to dispense with locomotive springs or to make them so rigid that the engine would ride hard and therefore enjoy the desired vibration. Others would say that there is no use having a smooth track, since running over it reduces the efficiency of the boiler, and so they would neglect low joints and help along with everything that conduces to a rough-riding track. Truly, it is fortunate for the poor



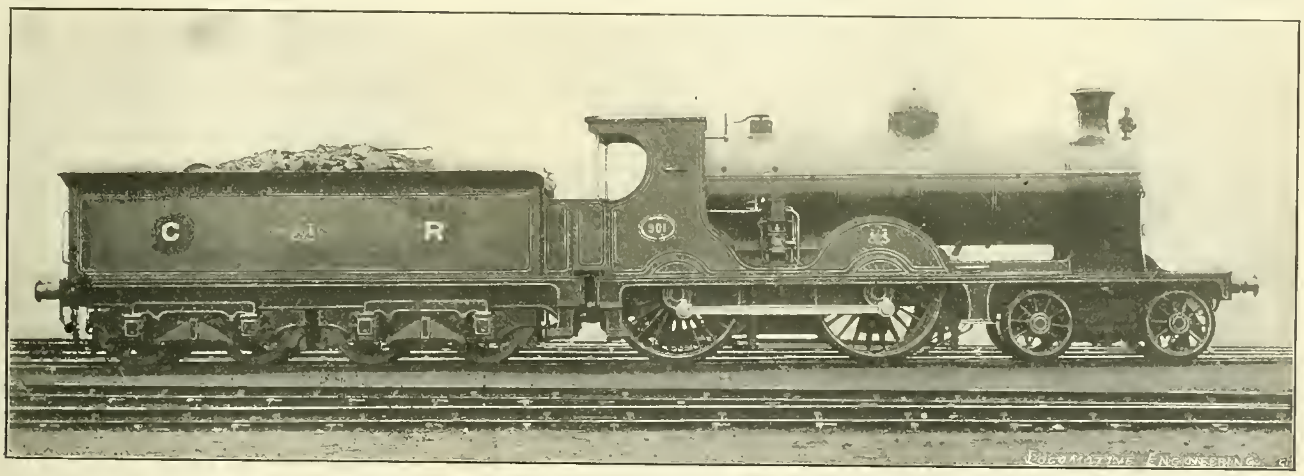
A CONRADSON SEMI-AUTOMATIC TURRET LATHE. TURNS THE CONES SHOWN IN 45 MINUTES. MADE BY AMERICAN TURRET LATHE CO., WILMINGTON, DEL.

creatures who have to ride on locomotives that the theory of vibration promoting the steaming of a boiler proves to be a fallacy. The only people who will lose by the discovery are Stannard & White, whose seat would have become an absolute necessity when the rough-riding era came round.

Caledonian Bredalbanes.

The annexed engraving shows the latest style of express locomotive designed by Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway of Scotland. This is an enlargement of the "Dunalistair" class of express engine, which proved one of the most efficient locomotives ever put in service in the British Isles, and which brought the designer international celebrity. This engine is called the "Bredalbane" class, and has been making an excellent record in pulling heavy express trains.

The new engines are intended by the directors to cope single-handed with the increasing loads of the West Coast expresses over the heavy mountain grades of their main line. They have been given very powerful dimensions, as will be seen from the figures given below. The new engines, which are of the four-coupled with leading bogie type, have driving wheels 6 feet 6 inches in diameter; the cylinders are 19 x 26 inches, and are supplied with steam by a boiler having 1,600 square feet of heating surface, and steam pressure of 200 pounds to the inch, the boiler tubes being 269 in number and 11 feet 7 inches in length. The engines weigh 125,800 pounds, of which 80,000 are on the driving wheels. The tender runs on a pair of four-wheeled bogies, and carries 5 tons of coal and 4,125 gallons of water, the weight being 45 long tons, or the total weight of engine and tender 226,600 pounds. The special fitments include McIntosh's patent gage protectors, steam-saving devices, steam train-heating and Westinghouse brakes, while special arrangements include the concealment of all pipes, brake rods, etc., so as to make the engine look as symmetrical as possible; and this, combined with the Caledonian well-known blue, black and white colors, and the company's coat-of-arms on the tenders and splashers, gives the new engines a fine appearance.



ONE OF THE CALEDONIAN RAILWAY "BREDALBANE" CLASS.

Getting Out Mahogany Trees.

The mahogany hunter is the most important and best-paid laborer in the service, for upon his skill and activity largely depends the success of the season. Mahogany trees do not grow in clusters, but are scattered promiscuously through the forests, and hidden in a dense growth of underbrush, vines and creepers, and it requires a skillful and experienced woodsman to find them. No progress can be made in a tropical forest without the aid of a machete, for the way must be cut step by step. The mahogany is one of the largest and tallest of trees, and the hunter, seeking the highest ground, climbs to the top of the tallest tree and surveys the surrounding country. His practiced eye soon detects the mahogany by its peculiar foliage, and he counts the trees within the scope of his vision, notes directions and distances, and then, descending, cuts a narrow trail to each tree, which he carefully blazes and marks, especially if there is a rival hunter in the vicinity. The axmen follow the hunter, and after them come the sawyers and hewers.

To fell a large mahogany tree is one day's task for two men. On account of the wide spurs which project from the trunk at its base, scaffolds must be erected and the tree cut off above the spurs, which leaves a stump from 10 to 15 feet in height —a sheer waste of the very best part of the tree, and one which American ingenuity would certainly devise some means to prevent. While the work of felling and hewing is in progress, other gangs are busy making roads and bridges over which the logs may be hauled to the river. One wide "truck pass," as it is called, is made through the center of the district occupied by the works, and branch roads are opened from this main avenue to each tree. The trucks employed are clumsy and antiquated affairs which no American would think of using; the axles and boxes are imported from England, while the other parts are made upon the ground. The wheels are of solid wood, made by sawing off the end of a log and fitting iron boxes in the center, no spokes or tires being used. New wheels are in constant requisition, and repairs cause frequent and expensive delays. Most of the trucking is done at night by torchlights of pitch pine. The oxen are fed on the leaves and twigs of the bread-nut tree, which gives them more strength and power of endurance than any other obtainable food. The trucking being done in the dry season, the logs are collected on the bank of the river and made ready for the floods. On the longest rivers these begin in June and July, and on others in October and November. The logs are turned adrift, and when they reach tide water are caught by means of booms. Indian loggers—usually Caribs—follow the logs down the river in order to release those which are caught by obstacles. No little judgment and experience are required to determine at what exact stage of the flood the logs should be set adrift. Should the water rise to what is called "topgallant flood" before the logs reach the boom, many of them would be carried over the banks and left high and dry in canebreaks and thickets, or covered up by sand and rubbish. From the boom the logs are rafted to the embarcadero and "manufactured" for shipment.

Mahogany trees give from two to five logs each, measuring from 10 to 18 feet in length and from 20 to 44 inches in diameter after being hewed. The "manufacturing" process consists in sawing off the log ends which have been bruised and splintered in transit down the river, and in relining and rehewing the logs by skillful workmen, who give them a smooth and even surface. The logs are then measured, rolled back into the water at the mouth of the river, and made into rafts, to be taken to the vessels anchored outside the bar.—*Self-Culture.*

Hub Liners.

There is quite a diversity of opinion in regard to the proper way of putting in hub liners—each road having ideas of its own on the subject.

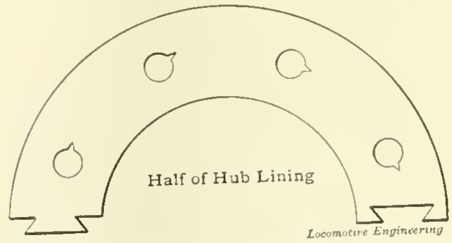
Some put in a solid ring and force it into the hub, as well as forcing the axle into it. These are said to stay in place and to give no trouble.

Other roads cast them into the hubs, putting a piece of thick, soft paper around the axle and allow a little take-up for the shrinkage of the metal in cooling. These are also said to give good service, and it doesn't seem to matter if they do get loose, for they become a loose washer between hub and driving box.

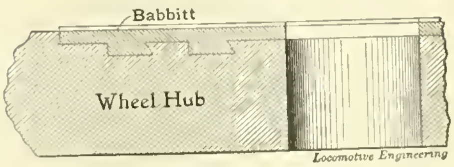
Still another way is practiced by the Lehigh Valley, and equally good results are reported. These are made in halves, as shown in the sketch, the ends being dovetailed together. They have holes through which copper studs are screwed into the hub, and the heads riveted into countersunk holes. They also have a "V" cut out of the side of each hole, and the soft copper filling this effectually prevents the stud backing out. This is about the neatest scheme for this we have seen.

The backing out or loosening of screws holding hub liners has long been a source of annoyance, and various devices have been tried. One of the most effective was to make the screw a tight fit in the hole, depending on the friction of a good bearing on all the surface of the thread.

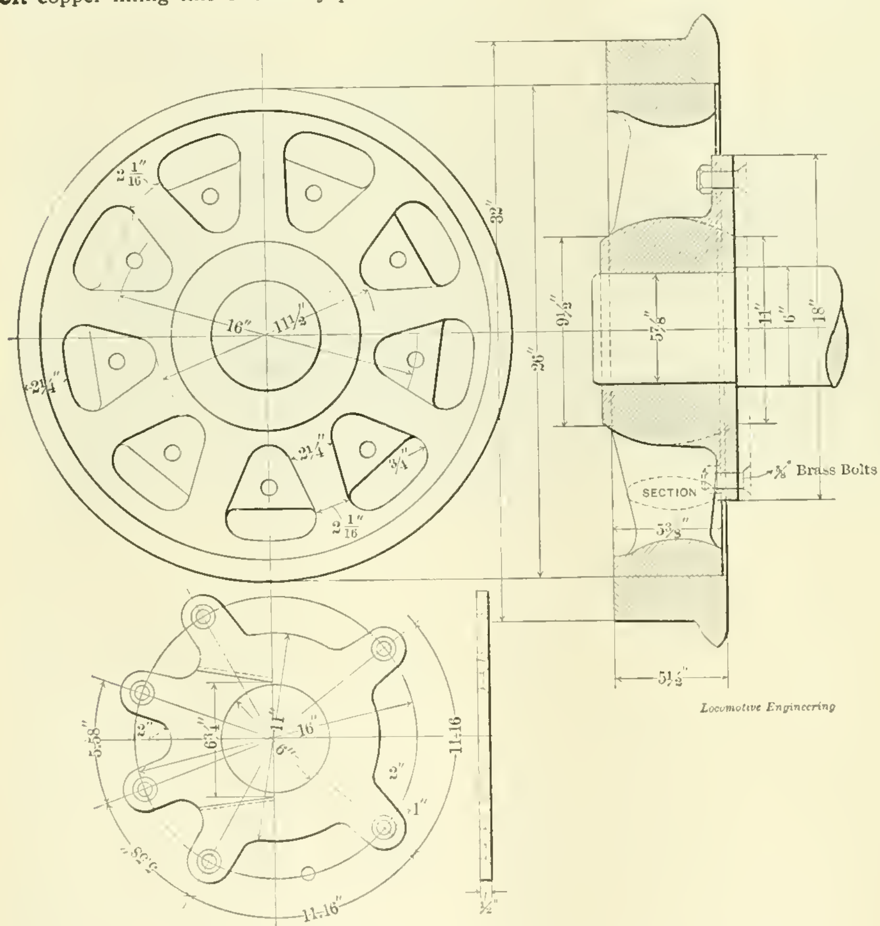
Mr. F. T. Hyndman, master mechanic of the Pittsburgh & Western, Allegheny, Pa., has adopted a novel form of bronze hub liner, as shown in the two illustrations—one for trucks and the other for drivers. Little explanation is necessary, as it is plainly seen they are made in two parts, so as to admit of change without taking wheels out, and are bolted to the hub of wheel. These bolts are far enough away from the center to clear the boxes so that changing liners becomes an easy matter.



LEHIGH VALLEY RAILROAD PLAN.



JUNIATA HUB LINER, P. R. R.



HYNDMAN'S HUB LINER FOR TRUCK WHEELS.

There is a slight difference in the construction of the two, but this is simply to meet the requirements of the different cases. They are said to be giving very satisfactory service.

At the Juniata shops of the Pennsylvania they are using babbitt, but they groove the hub in such a way as to make loose liners almost unknown.

As will be seen, these are dovetailed on the inside, so that the contraction will make them hold tighter. While this may not show the exact proportions or shape of groove, it gives the idea employed.

Kansas Populists Against Railroads.

Nearly all railroad men in Kansas were disconcerted last year by a law passed by the Populist Legislature, which took away from railroad managers the control of their property and put it into the hands of politicians. Railroad men may occasionally feel hard towards the officials in charge of them, but it is very rare that they would prefer to be managed by politicians.

The law which the Populists enacted after they had been defeated at the polls, repudiated by the people, created a special court, with judicial, legislative, and executive powers. The court was not only empowered to fix rates at its own discretion and wholly regardless of whether the rates so fixed were sufficient to pay expenses, but it could even oust the officers chosen by the owners of a railroad and put its own men in charge. It had power to make absolute rules for the construction of stations, stockyards and switches, and to regulate the running of trains. It could enforce the use of any appliance for safety or other purposes that its members might care to adopt. It could settle strikes, and its decision was binding upon both employer and employed. It was the most drastic and comprehensive act ever passed in this country for the government of public corporations.

This measure the Kansas Supreme Court has declared contrary to the fundamental principles of American government. That legislative, judicial and executive powers must be separated is a rule which permeates organic law. The Kansas railroad law gave all these powers to the same men. These men could practically legislate to deprive the owners of a railroad of their property, decide as a court that their own act was valid, and then proceed to put that act in force. The American system of civil government never contemplated that powers so vast, unrestrained and despotic should be lodged in any man or body of men. So, when the Supreme Court got at it the railroad law had to go. Even the Populist members of the Supreme Court remembered that they were lawyers before they were partisans, and that they had sworn to support the constitution of the United States and Kansas.

Promoting the Comfort of Workmen.

The Cleveland Hardware Company have been pursuing several plans for the moral and intellectual benefit of their employés. They have a mutual aid society, a restaurant at which food is sold at the actual cost of the material, giving them a pint of coffee for 1 cent, and other articles of food in proportion. They have an orchestra, formed of their employés, which plays every Monday evening at the offices of the company, to which entertainment the workmen and their families are invited. They have a branch of the public library, and to encourage a further interest in reading, they are getting up a permanent library for them, and to increase their interest in this library are asking prominent people all over the country to contribute a book with their signature on the fly-leaf.

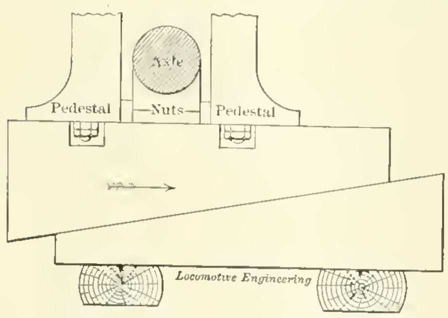
This is a very practical enterprise, and we commend it to our readers. Anyone having a book to spare will perform a good action by writing his name upon the fly-leaf and sending it to the Cleveland Hardware Company.

Changing Truck Brasses.

With the heavy engines of modern design, especially where an engine truck brake is a part of the equipment, it is a hard matter to raise an engine truck box to get out a hot brass and put in a new one. There is very little room to work at a jack, and the confined position prevents a man using his full strength. The engine must be spotted to get a good foundation for the jack on a tie, and part of the weight must be usually taken off the truck by another jack under the front end of engine.

This makes a combination of difficulties, so great that a hot box is run till it is necessary to supply another engine or the train gets to a terminal. There is no use expecting that a set of jacks, which can do this work easily, will be furnished each engine to ride around in the tender box waiting for a job. Only the very best jacks will do this work for a heavy engine. There are too few of them in roundhouses to allow any in a tender tool-box; some roads do not furnish jacks to engines at all. We think that the best device in such a case is a pair of wedges.

Engineer E. W. Richmond, of Grand Rapids, Mich., uses two hardwood wedges, 24 inches long, 6 inches wide on the bottom, 8 inches at the thick end, 2 inches at the other. The under wedge should be thick enough to reach from the tie to within 2 inches of the truck binder. The under wedge has a couple of iron spurs, ¾ inch long, to catch in a tie and prevent the wedge slipping along. The upper wedge has holes cut in its top face to take in the pedestal bolts and nuts, so the wedge will set up fair against the binder. The bottom wedge is set where it will reach across two ties; the upper one up against the binder. Take out cellar block up between binder and lower edge of truck box, move the engine ahead so that the wedges slip one on the other, and raise the truck box up high enough



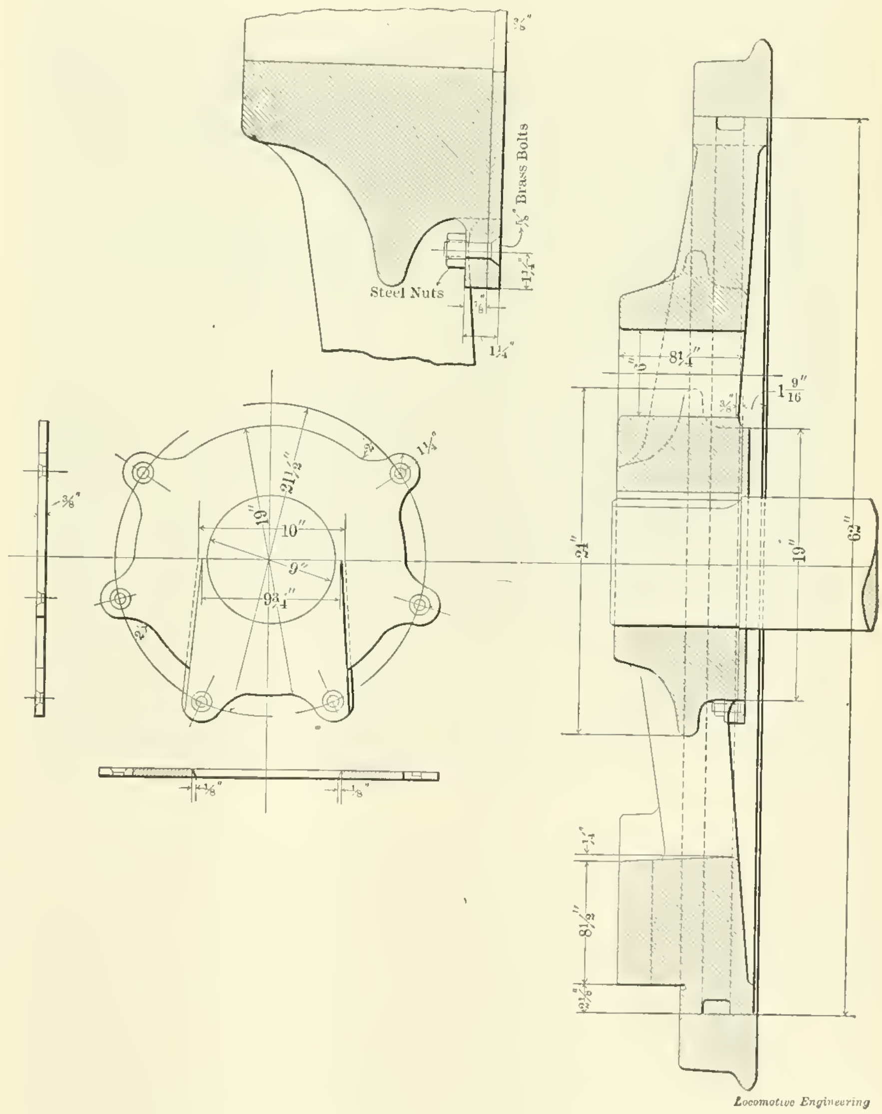
WEDGES FOR CHANGING TRUCK BRASSES.

to clear the brass. The engine can then be held with the brake or wheels blocked, while the brass is changed in short order. Eight to twelve minutes is the usual time consumed. These same wedges, if of the proper thickness, can be used to change a tender brass quite handily. They can be made longer than 24 inches if necessary, but should be thick enough to fill in the space between the tie and bottom brace or binder. When you get your set made, try them at the engine house before you have to use them on the road, and you will get some pointers on quick work.

Justice Between Employer and Employe.

There is great unrest in the labor world at present and conflicts are going on in various trades and in various districts between those who have labor to sell and those who desire to buy it. Labor is more independent than it was three years ago, and is inclined to stand out for a good price. Three years ago the labor market was overstocked, and some employers stood grimly by the infernal law of supply and demand that screws labor down to starvation price when there are few people wanting to purchase it. Those who followed this policy when their opportunity was on cannot justly complain if the other side adopts similar tactics when their turn has come.

Justice at all seasons is really a paying investment between employer and em-



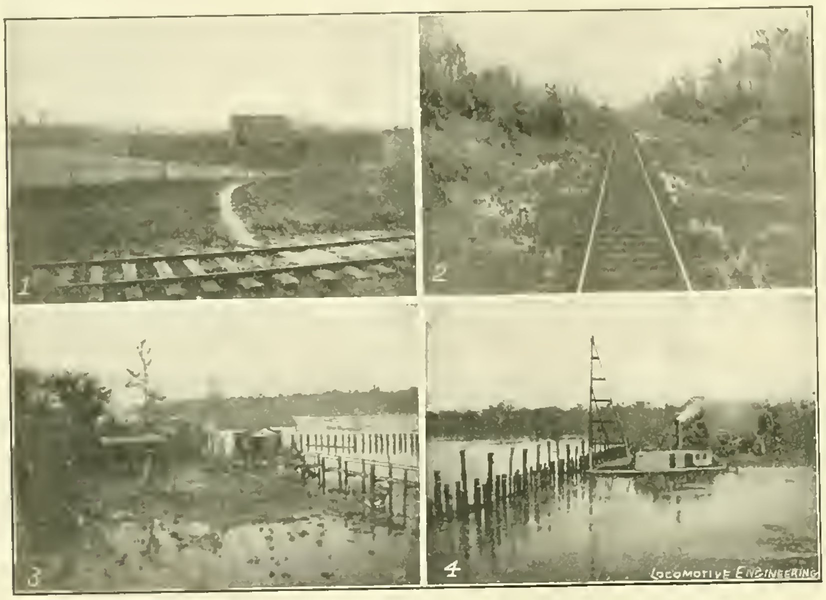
HYNDMAN'S HUB LINER APPLIED TO DRIVING WHEELS.

ployés. The following article, that appeared in the *Engineering Magazine*, is a good illustration:

In an address before an association of manufacturers recently, a practical economist, who is himself an extensive manufacturer, made the following significant statement when speaking of the beneficent results flowing from the national arbitration of labor disputes in his line of business:

"The result of all this is, that we have had absolute peace in our business. In the management of our business during these thirteen years I do not think we have ever given a single day to the consideration of labor questions, and never have been compelled to publish on our letter-head that 'All agrements are subject to strikes and other occurrences beyond our control.'"

So happy a condition of one very large



1. CABIN BY THE ROADSIDE. 2. OVER THE SWAMPS.
3 AND 4. IMPROVEMENTS AT THE SAVANNAH RIVER. SEE PAGE 267.

manufacturing industry is chiefly the result of intelligent co-operation among manufacturers whose plants are widely scattered over the United States, and whose employés are to a large extent members of an aggressive union. In this instance the union was a fixed fact long years before the manufacturers had considered the utility of co-operation. The relation of employer and employé had become so strained in that trade that financial ruin was imminent. Strikes, often of great violence, were occurring several times annually. Conditions became unbearable, as well to the employé, who was a continual loser by his acts of depredation, as to the employer, who was steadily drifting on the rocks.

In desperation, seeing the inevitable failure of separate endeavor and isolation, a few manufacturers met and laid the foundation of an organization that has now the pleasure and profit of reflecting upon the peaceful and prosperous picture faithfully portrayed by its most distinguished member in the words above quoted. The significant feature of this particular case is the fact that the employé is as well satisfied as the employer.

Self-interest is the powerful incentive that is first invoked to urge manufacturers into alliances for mutual protection. If this, however, were the only reason for co-operation, it is doubtful whether the far-seeing economist would approve of such an organization. If the National Founders' Association, one of the most powerful of manufacturing organizations, were simply a fighting machine with its guns trained on labor unions, its claims of usefulness would be challenged by every right-thinking man. If the same association were a trade trust whose object was to purchase the service of its employés at the greatest possible bargain, and in turn to dispose of its product at prices induced by some contravention of the natural laws of trade, it would be open to the strongest censure.

Without desiring to direct attention to any particular association, but with the sole object of presenting a type of the greatest interest, it is pertinent in this connection to give the following extract from the constitution of the National Founders' Association:

"Article II, Section 1.—The objects of this association are: First, the adoption of a uniform basis for just and equitable dealings between the members and their employés, whereby the interests of both will be properly protected; second, the investigation and adjustment by the proper officers of the association, of any question arising between members and their employés."

It will probably be conceded that this "object" is pacificatory—in fact, that it exhales the very spirit of peace and good will.

The organization founded upon this basis is intensely practical. During the past year its good offices have been invoked scores of times to relieve strained conditions, and success has been achieved in nearly every instance. Not only has it been able, through the co-operation of its employés, to prevent strikes and lock-outs, but the association has entered the field of arbitration upon a plane seldom attained by anyone except theorists. It has not only shown wisdom in dealing with the concrete relations of employer and employé, but has begun with great zeal to investigate some of the fundamental questions of social economics in their bearing upon the always complicated relations of employer and employé. In the consideration of these subjects and their practical application, the manufacturers have invited and secured the hearty co-operation of one of the most powerful trade unions now to be found among American organized labor.

The association of manufacturers cited has at least two prototypes whose constitutions are practically identical. Broad as these constitutions are, the actual work of these associations is still broader. They have discovered common ground upon which the employer and employé may safely meet. They have eliminated, to a large degree, the common distrust and the consequent violent contentions. Partial failures to avert industrial wars have been so rare as to invite the hope of ultimate complete success.

If it is possible for one branch of industry to achieve emancipation from the exhausting industrial wars, the irresistible inference is that it is equally possible for all trades to do likewise. Many other conclusions are obvious, one of which is, that it is a solemn duty laid upon the employers of labor jointly to promote, by organized effort, the mutual loyalty and prosperity of employer and employé. From their vantage ground, the employers should make the first advances. With honest endeavor and with clean hands they should take up the economic questions and invite co-operation from both organized and unorganized labor. They should not allow themselves to become cynical when forced to join issue with the worst phases of unionism. Let them first examine their own position and see if it is founded on justice. Satisfied upon this point, let them bring the whole influence of their financial strength against the encroachments of a tyranny that, however it may oppress capital, is infinitely more blasting in its effects upon labor. Labor organizations have a mission that is justified in every rational mind; but in unwise hands the power of labor organizations often becomes a grievous menace. The members of labor unions sometimes find that they have placed shackles upon their own wrists that they are powerless to cast off. Against such slavery—against the proposition that honest men and good mechanics may be arbitrarily deprived of their rights and driven into helpless poverty—it is the duty of the manufacturers to stand like a stone wall. It is equally their duty to inculcate within their own ranks a spirit of equity that will lead to absolute justice in their relations with their employés.

In reviewing the work of a manufacturers' convention recently held, an impartial critic said:

"Evidently a deep sense of the great responsibility resting upon their shoulders was felt by the employers present in that assemblage, many of whom exercise authority in that capacity over hundreds of men. It was, therefore, with no light or trifling manner that they decided questions of policy or principles which were brought before them for determination. Without losing sight of the fact that they might at any time be forced to take stern measures to preserve their own rights and perhaps their own business existence, they showed that they were animated by higher motives than the endeavor to get the largest possible profit from the employment of other men. If all defensive organizations can be established and conducted upon the same high plane, the irrepressible conflict between capital and labor will be shorn of much of its unpleasantness.

"To reduce the friction which has seemed hitherto unavoidable between the manager's office and the workshop, is a consummation most devoutly to be wished. To eliminate the local business agent and his petty tyranny, and to substitute national agreements between the chief executive officers of employers' and labor organizations, is an enlightened step. It is a movement promising the greatest possible good to both parties. From the broader view of a national standpoint, the perspective is very different from that appearing to the vision limited to the office or shop. Both sides look out on a wider horizon and get a clearer perception of principles. Removed from the local environment men's ideas clear up and trivial contentions are forgotten. The new conditions beget a kindlier feeling and mutual forbearance.

"Nor is this all. The manufacturers' associations have been singularly educative. They have certainly broadened the members' views and made them more tolerant of one another. Without in any degree cultivating the slightest tendency toward trusts, as the term is commonly and correctly understood, these associations have led to serious inquiries into shop practices and to the almost total extinction of every undesirable condition. They have, in a large degree, brought about a uniformity of action along well-considered lines and elevated the tone of the whole industry.

The labor unions have shown manufacturers the necessity of combining for protection, and some, at least, of the manufacturers' associations have shown the way to peace, without employing drastic measures and without dishonor to either side."

Snap Shots on the Road.

Having had the camera fever for several years—it being, in fact, a chronic case—couldn't help taking it on the trip to Jacksonville, and some of the views may interest others as well.

Going down over the Southern, or any road in that section, shows a different state of affairs than we are used to, as will be seen by a few random shots in group 1. The darkey's cabin takes us back to former days and was snapped on the fly. It does not represent the South as a whole any more than the "East Side" represents New York, but is interesting nevertheless. The others give an idea of the swamps and long trestles necessary in some places, while the Savannah River views show that improvements are being made by the Southern along its line.

Group 2 takes us on the Florida East Coast Railroad, which controls the east coast of the peninsula just as the Plant System does the Gulf coast. You hear grumbling about monopoly among some of the travelers here, and especially at the rate of fare, which, I believe, approximates 5 cents a mile. It is a monopoly, it's true; but there's another side to it. Take away this railroad (or the Plant on the other coast), and what would happen? This is best answered by looking at the condition before the road came. The Indian River oranges had to be marketed by steamer instead of by rail, and the time necessary placed the fruit raisers at a disadvantage. Encouraged by the means of transportation, even at higher rates than in the North, the east coast is being settled, and pineapples, lemons, etc., are being raised. True, some of the towns are only winter resorts, but who would say that Asbury Park, Buzzard's Bay or Bar Harbor were of no value because they are fully peopled but part of the year?

Then the cost of operating the road is heavy. It is only a winter road, as the summer traffic is practically nothing. The whole roadbed is sand, and how any journal stays cool is a wonder, after seeing the amount of sand that lodges on every part of the truck. Sanders are entirely unnecessary, and the brake shoes take hold in a manner that leaves no doubt as to the engineer's intention to stop. All this adds to the expense of operating, and must be paid for by the traffic.

FLORIDA SAWMILL. BRIDGE OVER ST. JOHNS RIVER.
INDIAN RIVER, PALM BEACH. EATING ORANGES, INDIAN RIVER.
AVENUE OF PALMS, PALM BEACH. BY STATION AT ST. AUGUSTINE.

And there is another side. Mr. Flagler, who practically owns the east coast, has spent money like water to make it attractive. He has built the famous Ponce de Leon Hotel and the Alcazar, both at St. Augustine. He has made Palm Beach a tropical dream by setting out cocoanut palms, date palms, and almost everything you can think of to attract the tourist. He built the Royal Poinciana Hotel and the Palm Beach Inn, and the money these represent would stagger any of us ordinary mortals. Naturally he expects a return on his investment, and is probably getting it. He deserves to at any rate, for it gives employment to several thousand people and makes several other attractions to this resourceful country of ours.

Leaving Jacksonville, you cross the beautiful St. Johns River on the iron bridge shown in Fig. 1, and you strike almost immediately into the woods and brush. Low palms abound, but the trees are tall and straight, with the bunch of small branches and leaves at the top. Settlements are not very plentiful, but occasionally you run across a sawmill, as shown in Fig. 2—although the mill is about hidden behind the pile of sawdust, which reminds you of the culm piles around the mines in Eastern Pennsylvania. The station at St. Augustine is particularly attractive, the palm garden adding much to the traveler's first impression of the town. Palm Beach defies description, unless one uses all the adjectives he knows, and then he wishes he had more. The palm trees, the Indian River and its banks, and the entire change from usual sights must be seen to be appreciated. The Indian River without oranges would have been incomplete, and a fortunate chance made us acquainted with the genial ex-Mayor Swift of Chicago, who was more than kind in his attentions. He is standing under the tree cutting an orange just picked, while the S. P. and the rest of the party are waiting for their turn at the oranges. C.

A 100-Pound Pneumatic Hammer Built at St. Paul & Duluth R. R. Shops.

We are indebted to Mr. George D. Brooke, master mechanic, for photograph and the following description:

This hammer is single frame, stands about 5 feet high and weighs, complete, about 1,200 pounds. Piston and top die weigh 100 pounds. Piston diameter 6 inches, and full stroke 4½ inches. Air pressure used, 120 pounds, and will do perfect welding up to 1¾-inch diameter iron, with variable blows from 800 to 1,200 per minute.

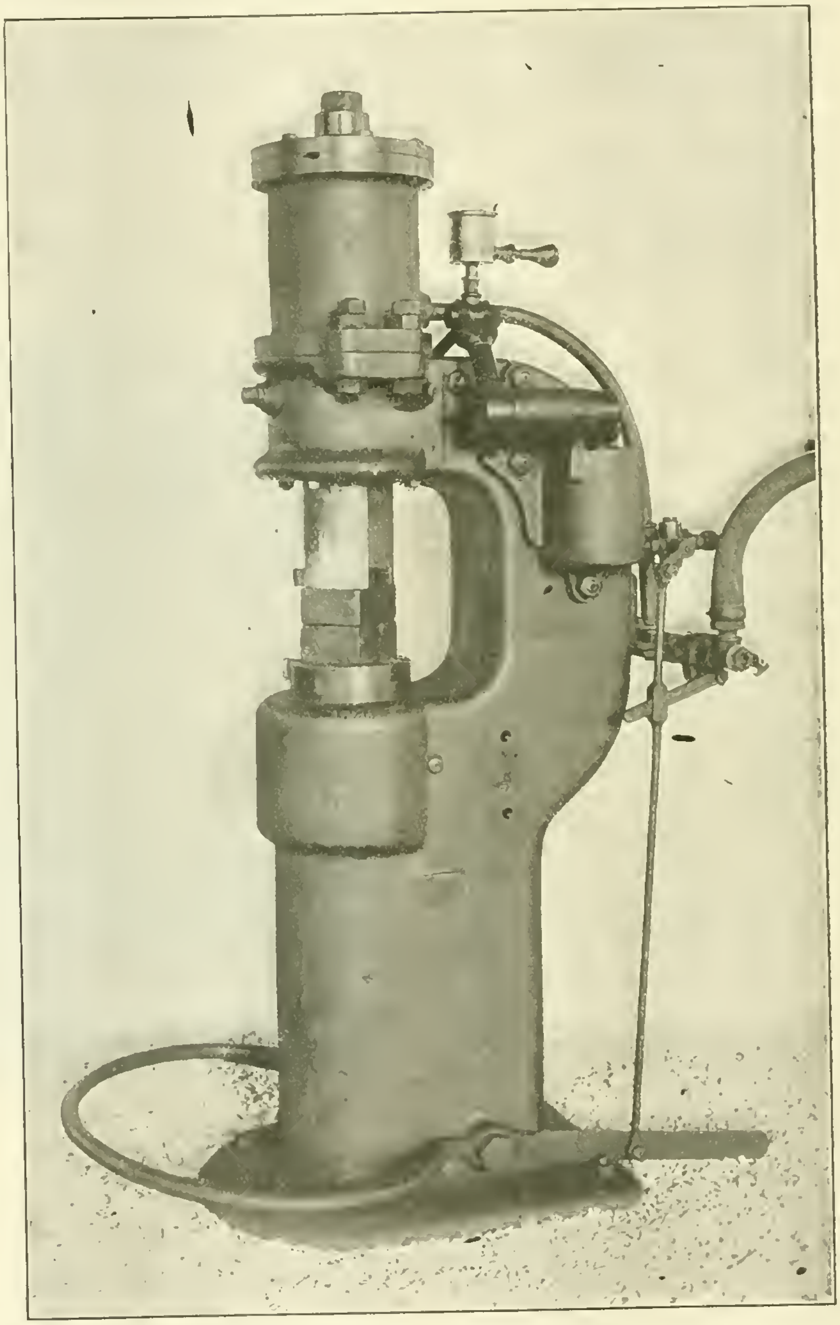
In attaching air brake and couplers to our cars a suddenly increased demand for rapid welding manifested itself, which we endeavored to meet by using our small air hammers with fixed stroke that we had been using for some time for flue welding.

We found that these hammers were too light to do good welding of iron exceeding ⅞ inch in diameter, and the fixed blow prevented the smith from regulating the force in proportion to his degree of heat in the pieces to be welded. It soon became apparent that a variable and easily controlled stroke was most desirable, as well as a variable intensity of blow. To have both of these features controlled by one treadle, so that the smith could run the hammer without help, was another condition that naturally followed, and in the hammer as detailed by the drawings sent you we have met these requirements, by having a variable stroke of 1¼ inches and under such perfect control that the smith can separate dies to enter work and lay the iron together for welding by pressure before the hammering is begun.

The method of use is as follows: The smith depresses the foot treadle slightly, which gives light blows about an inch above the bottom anvil, and to strike a harder blow the depression is increased until the treadle is pressed to the ground, when the maximum blows are delivered.

For a light blow on the anvil the treadle is raised to the center position, and for light blows above the anvil it is raised a little and brought back to center.

With a little practice the smith can



100-POUND PNEUMATIC HAMMER BUILT AT ST. PAUL & DULUTH RAILROAD SHOPS.

to about the position as shown in Fig. 1, which raises the piston with the die attached; then the work is placed in position and the treadle released, the spring on one side raising it and closing the lever throttle valve marked *A*, allowing the piston to descend.

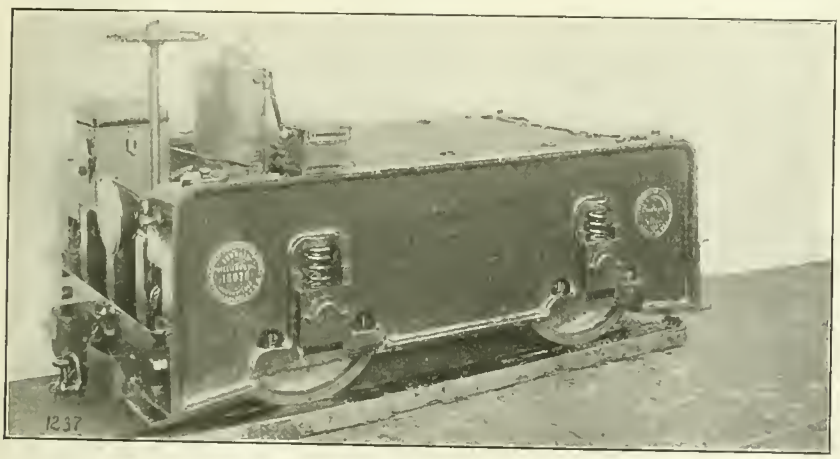
To start the hammer he depresses the treadle quickly to the position shown, graduate the blow as readily as it is done on a steam hammer with two levers. To illustrate how this is accomplished, a short description is probably necessary. The hammer is of the valveless type; that is, the piston controls the admission and exhausting of the air in relation to its movement. In connection with this we have a regulator that controls these functions in regard to the piston movement in the cylinder. This regulator is in the form of a sleeve or bushing in the lower part of the cylinder and the upper part of the frame, and is carried on three rollers working in the spiral grooves on the lower part of the sleeve. These rollers are supported by three set screws, shown just below the joint of the cylinder and the frame. The regulator is connected through the rock shaft with the piston in the small balance cylinder on the side of the frame. The air pressure in the balance cylinder is controlled by the three-way valve *B*.

In the position shown in the photograph the throttle valve *A* is closed and valve *B* is open to the balance cylinder; now a slight depression of the treadle will open throttle *A* and the air will pass through the pipe to the cylinder and act on the top of the regulator to force it down, but this is opposed by the same pressure in the balance cylinder acting on twice the area to raise the regulator, consequently the hammer piston will work in the upper part of the cylinder

purchased, instead of being scarfed before welding by the smith, are sent to the shears and have the stub ends cut at an angle to a given length by specially prepared cutters, giving us a positively clean scarf surface. The rods to which they are to be welded are cut off square to a given length.

At the hammer we have special small coke furnaces, open at both sides, which allows the helper to heat the stub end of the jaw at one side, while the smith is heating the rod at the other. When the heat is ready the pieces are taken to the hammer, the helper laying the stub in the lower die and the smith placing the rod on it, lapping the cut scarf more or less, according to the diameter of the iron being welded, and after starting the hammer the weld is finished in about 50 seconds from furnace to completion. In connection with this work we had rather an amusing experience. The smith made complaint that the iron became so hot while he was hammering that it would sometimes melt and run. An investigation revealed the cause to be a small jet of compressed air that was being used to keep the dies clear of scale. By experimenting, we found that a piece of iron heated to a bright cherry red and held in a jet of air would increase in heat sufficient to be welded, and if held there long enough it would burn; in fact, we have burnt off a bar of iron 1⅛ inch round in less than a minute with a jet of compressed air from a 3-16-inch opening, starting with a cherry red heat in the iron, the iron melting and flying about in a shower of sparks. We still use the jet and diminish the heat of the iron when taken away from the furnace.

The working out of the details of these hammers and putting them in successful operation was done by Mr. W. O. Johnson, foreman of tool room at these shops.



BALDWIN ELECTRIC MINING LOCOMOTIVE.

Depressing the treadle to a horizontal position, as shown in Fig. 1, closes valve *B* and opens the throttle so that the hammer will strike its maximum blow in this position. A further depression of the treadle will open the other port of valve *B*, exhausting the air from the balance cylinder, allowing its piston to descend by reason of the higher pressure on the regulator. Valve *B*, having a certain amount of lap, or, in other words, a movement in the central position without opening either port, allows a graduation of the throttle to suit the work in hand.

The regulator is also easily controlled, as it is not necessary to admit or exhaust all of the air in the balance cylinder at any one time, but it can be graduated either way, giving a corresponding movement to the regulator.

As soon as we had gotten our large pneumatic hammers to work we found that it was not necessary to heat and scarf the pieces to be welded in order to get a perfect weld. Our brake jaws, which are

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The New York, Ontario & Western have recently installed in their shops a duplex steam-driven air compressor built by the New York Air Compressor Co.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(56) L. J. C., Trinidad, Colo., asks:
What is the proper shrinkage to allow on driving tires? A.—The American Railway Master Mechanics' Association recommends the following allowances:

Diameter of center, inches.	Shrinkage allowance, inches.
38	.040
44	.047
50	.053
56	.060
62	.066
66	.070

This is about 1-80 of an inch per foot, or 1-960 of the diameter; a common allowance is 1-1000.

(57) W. J. M., Kenny, Cal.:
Can you tell me how many revolutions an engine is capable of making per minute, using her own steam—that is, with a direct connection? A.—We do not see what difference a direct connection makes, if by this you mean having the valve rod connected to the link block instead of using a rocker arm. The stroke of the engine has considerable to do with the number of revolutions. About 1,400 feet piston speed a minute is the economical limit, although engines are running which make nearly 2,000 feet piston speed. If you will give us the bore and stroke of your cylinder and some other details, we will be able to figure this out for you more satisfactorily. If you wish to figure it out for yourself, divide the distance the piston travels while the engine is making one revolution into the number of feet piston speed that is given above; the quotient will be the number of revolutions.

(58) J. O., of Green Bay, asks a number of questions, which we will answer in their order:

1. What is the best way to clean out a lubricator? A.—1. If you think the lubricator is gummed up it should be treated to a bath of strong lye, which will dissolve all the gum or residuum which usually settles in the bottom of the oil tank. Take out the glasses and gaskets before it is put in the lye, as it usually ruins the gaskets. If this lye is put in the lubricator while on the engine, it does not need to be very strong, and can be left there over night. The next morning drain it out, wash out the lubricator with clean hot water, then by opening and closing the various valves see that the steam is blown through all the different openings, which will clean them out. If the inside of the glasses gets gummed up so the oil sticks to them, a chunk of yellow soap as large as a white bean dropped into the glass will stop this, as it will make the inside of the glasses so oil will not stick to them, and at the same time reduce the size of the drops; in

fact, when the soapy water is strong it will change the feed of oil from drops to a fine stream about as big as a hair. 2. How can I tell on which side the blow is located in an American balance valve when the springs break? A.—2. The American balance valve has no springs. The conical ring which comes against the pressure plate is held by the force of the steam against the cone ring on top of the valve, and does not require any spring. If this ring breaks, of course the valve will blow through, just the same as if one of the strips was broken or gone altogether in one of the ordinary balanced valves. There are a variety of ways of telling on which side of the engine the defective valve is located. It has been explained so many times, both in these columns and in the handbooks on breakdowns, that we would refer you to one of them. 3. What ails my monitor injector hose. Give us more details of your trouble, and we can answer to your satisfaction. 4. Has anyone ever tried placing an air pump on an engine in a horizontal position? Do you think it would be an improvement? A.—4. We cannot answer the first part of this question, as we are not acquainted with every man who operates an air pump and might miss the one man who has tried this. We do not think it would be an improvement, or they would have been placed that way years ago. 5. Take a six-wheel connected engine when it gets out of tram; do you think by adjusting keys and brasses it can be worked into tram again? A.—5. *No, sir.* 6. What can I do to prevent cinders in front end from taking fire. Would you advise a coarser netting? A.—6. Unless air can leak in the front end the cinders will not take fire from anything that comes through the flues. Keep your front end air

DUPLEX VAUCLAIN COMPOUND LOCOMOTIVE.

when it wastes water continually at the overflow? A.—3. There are more than twenty causes for an injector wasting at the overflow. If you will give us some of the details of how this particular injector works, we may then be able to locate the difficulty. Among them are insufficient steam pressure for the amount of water, improper shape of the tubes, which may be caused by filing them out or by an accumulation of scale. Sandy water soon cuts out the tubes and changes their proper shape so that the injector will not "pick up." The delivery pipe may be stopped up, so that the injector does not have force to handle all the water which goes through the combining tube and send it into the boiler. If the water coming out of the overflow has much steam mixed with it, it is a pretty good sign that the supply of water is limited, either at the lazy cock or at the strainer or in the tight. If the cinders gather in there in any considerable quantities, better have the front-end arrangement changed so the draft keeps the cinders cleaned out. 7. With a pint of soda ash in 3,000 gallons of water, would it be injurious for the hands or face to wash in it? How about drinking it? A.—7. A pint of soda ash distributed in 3,000 gallons of water would be one three-thousandth of a pound to a gallon. You would probably not suffer any serious injury from washing in this water.

Baldwin Duplex Compound Locomotive.

The annexed illustration shows a peculiar Vauclain compound locomotive recently completed by the Baldwin Locomotive Works for the McCloud River Railroad, which runs from Upton, on the Southern Pacific, to McCloud, Cal., a distance of 18 miles. The gage is 4 feet 8½ inches and the road has steep grades. The builders guarantee the engine to haul 125 tons of 2,000 pounds up a 7-per-cent. grade. There are essentially two engines, placed end to end, the cab of one extending over that of the other. Wood is used for fuel, and is carried in a rack on the fireman's side of each engine. The water is in tanks over the boilers, each tank holding 1,200 gallons.

The cylinders are 11½ and 19 by 20 inches, and the total weight in working order is 161,400 pounds, all carried on twelve drivers, 40 inches diameter. Steam pressure is 200 pounds. Total wheel-base is 38 feet 4 inches, with the driving wheel-base under each engine 9 feet 9 inches, and the length over all is 56 feet 2 inches. The center of the boilers is 5 feet 6½ inches above the rails, and the diameter of boilers at front ends is 46 inches.

Boilers are of the radial stay, straight-top type, and have fireboxes 4 feet 5 11-16 inches long, 2 feet 10⅜ inches wide and 59 inches deep. Altogether a tube-heating surface is provided of 1,804 square feet, firebox heating of 148 square feet, making a total of 1,952 square feet of heating surface. The total grate area is 26 square feet. There are 136 2-inch iron tubes in each boiler, 12 feet 9 inches long. Valves are of the piston type, and screw-reversing gear and the Le Chatelier brakes are used.

Special equipment includes standard tires, Nathan lubricators and Monitor injectors, Crosby safety valves, Leach sanding device, Westinghouse 9½-inch pump and other air-brake apparatus for train use, Ashcroft steam gages and United States metallic packing.

The Bethlehem Steel Company have opened an office at 4 Bank Block, Denver, Colo., in charge of Mr. C. S. Burt.

Odd Styles of Locomotives.

BY D. P. KELLOGG.

The modern high-speed and heavy-weight locomotives profusely illustrated in your paper show the product of recent invention. The accompanying cuts will give a little ancient history and new combinations. Fig. 1 is a suburban engine running out 7 miles; 16 x 24 inches, 80-000 pounds on drivers, total weight of engine being 103,800 pounds; 51-inch wheels. These engines are more useful than ornamental, and do first-class work. Some of the heavy evening trips that these engines make, they haul eleven and twelve coaches heavily loaded, make 14 miles, twenty stops to let passengers on and off, run around the train, and complete the trip in 52 to 55 minutes.

The principal feature of the engine that is out of the ordinary is a double valve on one valve stem. This arrangement gives a very short steam port and but little clearance. Most of the valves are set line and line in the corner, and this gives them about 7-32 inch in running notch.

These engines were made by the Central Pacific Railroad at Sacramento, Cal., under the supervision of A. J. Stevens, superintendent of motive power, and E. M. Luckett, general foreman, now master mechanic of Salt Lake division.

Fig. 4 is the first locomotive in passenger service on the Southern Pacific; was built by the Cooke Locomotive Works in 1863, and came to California around the Horn. It is a single driver, 55 inches in diameter; cylinder, 11 x 15 inches; 18,500 pounds on drivers, with a total weight of engine and tender of 39,000 pounds. This engine is still in service; has the old steam chest, oil cups, two air pumps, and is used for whitewashing and painting fences and buildings by the air atomizing process. This type of ancient locomotive is fast becoming extinct, and should be preserved and used to adorn a pedestal in the Union Depot or a public park, so that we might study the evolution of locomotive building, as the time will surely come when the originals will be more highly prized.

Figs. 3 and 5 show exterior and interior views of the first of the engines with Stevens valve gear ever built.

Fig. 2 shows our shop switch engine and traveling crane combination, which is worth more to the company than its size would indicate. It is so short that it will go on to a turntable with most any of the large engines without disconnecting their tender; consequently it is a labor saver in switching dead engines. The crane has an air hoist, is compounded for heavy and light lifts, so that it will pick up a pilot, a tender truck, a pair of wheels, smoke-stack, front end or steam chest cover, or any other heavy casting, and carry it any place where we have a track.

ODD LOCOMOTIVES ON THE SOUTHERN PACIFIC.

Locomotive Road Tests—How Should They Be Made?

At the May meeting of the Western Railway Club this was the subject of a report made by Prof. L. P. Breckenridge, of the University of Illinois, who has had considerable experience in this line of work since 1887 on the Boston & Albany Railroad and other roads, the last being on the Big Four.

The tests made on the Big Four road were made and recorded in a dynamometer car whenever possible Of course, taking temperatures of gases, weighing the coal used, measuring the water evaporated, etc., had to be done on the engine. Prof. Breckenridge is sanguine that continuous indicator diagrams can be taken of the steam distribution in the cylinders, the device to be put in motion and stopped from the car. Up to this time they have been taken by a man located right at the indicator. The drawbar pull was registered on a strip of paper, as well as the speed, which was recorded by one of those Boyer speed recorders, a revolution counter for the drivers, and the time recorder was operated by electricity to make the proper record in the car.

Locating these instruments in the car enabled them to be conveniently arranged, and gave the men plenty of room to do the work, which they could not have if they were on the engine. Of the thirty-five separate items required for a complete test, twenty-five could be taken from the car. In the table of results and data of the road tests there are eighty-two items considered necessary. In the discussion of the report, Mr. Angus Sinclair stated that such tests were usually too elaborate. This kept many parties from making them. Road tests were too often made with the best engines. Road tests, to be of value, should be made with the poor engines also, and thus be able to suggest certain remedies and improve the engines, instead of merely finding out what the best ones could do. He gave an instance of a poor steaming engine which was found to have, after going through the shop, an excessive amount of cylinder clearance, caused by the substitution of a very thin piston for the old thick one. Tests that would show such things would be valuable.

Professor Goss spoke of seeing some French engines tested. A supplementary cab was added on one side of the engine for the testing appliances and operators to ride in. He spoke of the point made by some, that a locomotive boiler making steam when standing still and when running on the track worked under different conditions. Tests which he had witnessed showed that these conditions did not affect the steaming qualities of a locomotive boiler.

Mr. Sinclair said he had heard this matter mentioned, and was glad to know that tests had settled it.

Mr. Manchester stated that dynamometer tests were valuable to the track department as well as the locomotive department, as they would show where the track had been raised above the proper grade and the train resistance thereby increased more than the profile in the office called for. These tests would also show the increased tractive force needed in the case of defective side bearings, which were known to eat up the power of the locomotive. The relative value of the different types of car tracks could also be determined accurately.

Mr. Delano spoke of simplifying the tests, so they could be made frequently, and try the old engines and locate defects.

Prof. Breckenridge, in closing, stated that at a slow speed the drawbar pull would show whether the valves were set to get the best work out of the steam; the cards made would locate this fact at once, and they could then, with the indicator, see how to remedy it.

Some Holland Locomotives.

One of our friends in Rotterdam, Mr. Cornelius Tromp, sends us several photographs he has taken of engines and trains of his native land. The first four views are on the Netherlands State Railways, the fifth on the Holland Railway.

No. 1 is one of the latest engines for express service, built last year and only put in commission in January. It has 7-foot drivers and weighs nearly 49 tons of our weight.

SOME HOLLAND ENGINES AND TRAINS.

No. 2 is a 6-wheel coupled express engine, built in 1895.

No. 3 is a limited train to Germany, photographed just outside of Rotterdam. It will be seen that American vestibuled cars are used. At Utrecht, 37 miles distant, four more similar cars will be attached, making a heavy train.

No. 4 is a vestibule train from Amsterdam to Paris, also taken near Rotterdam.

No. 5 is a Holland Railway four-coupled bogie express engine, which was built in 1891.

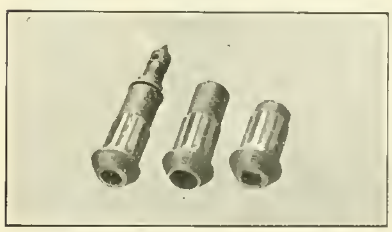
Mr. Tromp sends us some of the details of engines 364 and 473, which are as follows: Engine 364 is 18 x 26 inches, drivers $79\frac{3}{8}$ inches, truck wheels 39 inches, driving wheel base 9 feet, total wheel base 22 feet $9\frac{1}{2}$ inches. There are 221 tubes, $1\frac{3}{4}$ inches in diameter and 11 feet $5\frac{1}{4}$ inches long, which, together with a firebox surface of 106 square feet, gives a total heating surface of 1,235 square feet. Grate surface is 22 square feet and pressure 150 pounds. Weight on drivers 65,685 pounds, total 102,480. Built by Sharp & Stewart in 1891.

The other also has 18 x 26-inch cylinders, but has 84-inch drivers, 48-inch truck wheels, driving wheel base of 8 feet 4 inches, with 17 feet 6 inches total. There are 242 tubes, $1\frac{3}{4}$ inches in diameter. Total heating surface is 1,088.9 square feet, of which 105.2 square feet are in the firebox. Steam pressure is 150 pounds, weight on drivers 61,773 pounds, total weight 89,683 pounds. Built by Beyer & Peacock in 1895.

A Novel Ratchet Drill.

This is, without exception, one of the most practical novelties we have seen. Every shop man can recall many cases where a job has taken much more time than necessary, or has had to be given up, because they couldn't get at it with an ordinary ratchet drill. Something is in the way of the handle perhaps, and you can't get movement enough to drive the drill.

SHOWING BARREL AND PAWLS.



RATCHET FROM DRILL.

This drill is a regular Yankee trick, and, as will be seen, the handle is hung at an angle, so that any movement of the handle, no matter what direction, will drive the drill. It can be moved up or down, sideways or at any angle, and still it drives the drill, and with less loss of motion than other drills. It can be used as an ordinary ratchet, with the handle locked in any one of three positions, and has the advantage of being both simple and strong; in fact, is practically unbreakable. In spite of its universal movement it has no ball joints, all the bearings being straight, cylindrical and amply large. There are twelve strong teeth in the ratchet at 5 pawls, so arranged that the greatest possible slip is but one-sixtieth of a revolution or 2 inches at the end of a 16-inch handle. This means that it drives the drill about one-seventh farther with the same effort and with much less shock on the arm of the operator. The feed screw cannot be run out too far, preventing damage on this score, which is frequent in other ratchets. Every railroad repair shop needs one or more of these tools, and should send to the makers for further details. They are the Waterbury Tool Company, Waterbury, Conn.

CAB VIEW OF ENGINE 1366—SEE PAGE 271.

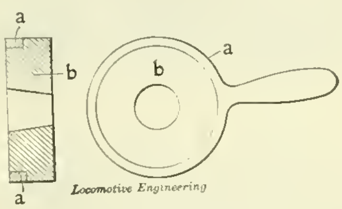
A Freak Locomotive.

Mr. D. Bell, of Chicago, has the plans drawn for a new type of locomotive that is designed to make a very high speed and reduce the operating expenses. As some other inventors may have hit on the same plan, we will here state that Mr. Bell is fully protected by patents.

The locomotive is to have two fireboxes hung from the back end of the boiler, like a pair of saddle bags of the "olden time." These boxes are of about the size of the ones proper for a 15 x 20-inch cylinder engine, but the small grate area and limited heating surface are to be made up for by an immense heating surface in the flues, of which there are three sets in the boiler. The first set extends from the firebox ahead to a big combustion chamber, another set then reaches ahead to the next combustion chamber; the third set of flues goes to the smoke arch. Some idea of the total length of these flues can be had when it is seen that the length of boiler and smoke arch is 74 feet. There are only four driving wheels under this engine and an independent four-wheeled truck, the same as an eight-wheeled standard locomotive. The gage of the track is very wide; two rails are laid down at each side instead of one. The flange of the wheels comes in the middle of the tread instead of at one edge; so the flange comes between the rails, and the double tread of the tire bears on both rails—a very good idea when you take the weight of the engine into consideration. It has 80 tons on the four drivers; with the two points of contact for each driver, it will have 10 tons on each rail.

The driving wheels on each side of the boiler will be of the same type as bicycle wheels, having an axle through the wheels and a crank on each and 90 degrees apart, so there will be no dead center. The drivers on the right and left sides of the engine will be independent of each other; but the pair on the same side are connected with parallel rods. They can go around a curve without slipping one wheel to enable it to keep up with the other. Of course, this engine is equipped with ball bearings everywhere—all the freaks are. The drivers are to be 126 inches in diameter, and a speed of 100 miles an hour will be the regular thing. The drawbar comes between the fireboxes and hooks on to a tender, 64 feet long, holding 90 tons of coal, so as to be sure and have enough for a trip. Water will be taken up with a water scoop, so the water space is limited to 4,000 gallons.

All the trucks are to have two center pins, because if one center pin is a good thing to let the truck move around and



SWAGE FOR FLUES.

adjust itself to the track, two will be better. These center pins are side by side and near the sides of the truck. The design for the car equipment is as novel as for the engines; but till the engines are completed and operated we will not disclose their details. Suffice it to say that they are to be on the same generous plan as the locomotive. Until the prejudice against electric locomotives for drawing trains on our steam railroads wears away from the minds of railroad men, Mr. Bell does not expect to bring forward his electric locomotive, which is as far ahead of the slow methods of the year 1900 as his steam engine is.

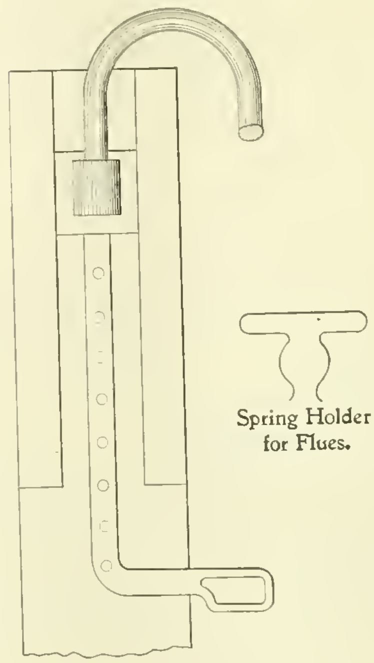
As soon as this plant is in operation, we will have our photograph editor, Mr. Nellis, take a snap-shot of the entire train and present it to our readers.

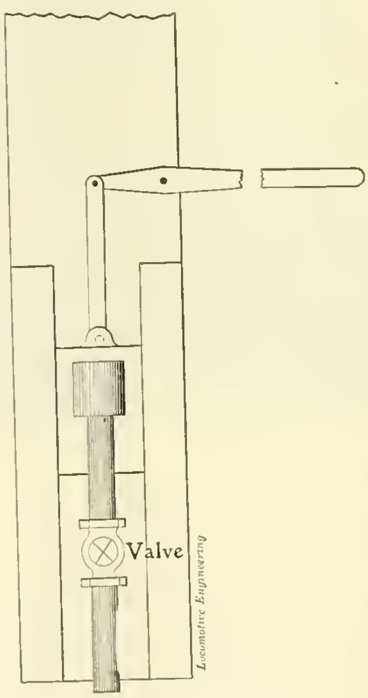
Swaging and Testing Flues.

This is another idea of Mr. E. P. Fitzgerald, of the Boston & Maine Railroad, in Springfield, Mass., and it has several good points. Space is quite an item in this place, so he ran his machine up the wall instead of out into the room. Both the flue swage and the tester might be said to be planks against the wall with air cylinders or connections at the top for doing the work.

On the swaging machine are several spring holders, as shown, into which the pipe is forced so as to require little holding by the operator. An air cylinder forces it down into the swage shown, which rests on a foot-block. This swage has a handle, as indicated, for convenience in placing it where wanted. For shorter flues they use distance pieces or blocks, and place the swage on that.

The tester is right beside it, and its main



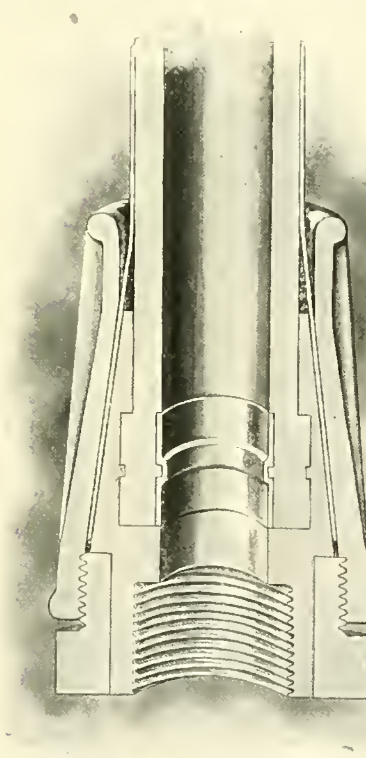


FLUE TESTER.

features are shown in the sketch. A hose connects the top cap with the air and water supply, and this is adjustable, as shown. The lower cap also adjusts by the lever to make a tight joint, and is locked in place while being tested. Water is admitted first, and is then subjected to air pressure. After testing and closing air valve, the outlet valve shown below is opened, and the water runs out an underground pipe without any splashing around the shop. It's a very neat rig, and seems to do the work in good shape.

The Gunnel Hose Coupling.

We show with this a hose coupling especially designed for making connections with armored hose. There is no question as to the utility of hose armor, as many users will testify, but it has not been entirely satisfactory in couplings, as the loose ends had to be provided for by wiring and soldering.



GUNNEL HOSE COUPLING.

The new coupling obviates this difficulty, and apparently ends this annoyance and expense. It is made by The John Davis Company, 51 Michigan street, Chicago, Ill., who will supply further information.

Testing Heavy Locomotive.

The Illinois Central mechanical department are making a series of exhaustive tests with four of their heaviest types of freight engines, with the view of ascertaining which kind of engine does the work with smallest consumption of fuel. The huge Brooks twelve-wheeler which we illustrated in our issue of November, 1899, hauled a train of over 3,000 tons weight from Kankakee to Chicago, over grades of 25 feet to the mile. When pulling on the hardest part of the grade the engine burned a ton of coal every two miles. Two firemen were kept busy shoveling in the coal. It was the most complete record of one-shovel firing. The attempt to load up the firebox went on without a stop.

After that trip the valves of the engine were changed, and we understand that while pulling its hardest, the engine makes eight miles to the ton of coal. Two firemen are still kept at work throwing in the coal, and they do not enjoy much of a holiday when the engine is working hard.

Care of Staybolts.

The serious accident of an explosion or the kind of rupture that endangers life is now rare with the boilers of locomotive engines, considering the great number in use and the high steam pressures now becoming the rule. When an accident does happen to a locomotive boiler nowadays, it is generally a bad one, because the combination of high pressure and great volume makes an aggregate of destructive force that is terrible when let loose. Under these circumstances it is nearly always timely to ask what is the most common cause of boiler explosions, and how can they best be prevented?

When a boiler explosion happens and the ordinary press reporter sends particulars all over the continent, he tells that the occurrence was supposed to result from shortness of water, or that the cause of the accident was a profound mystery. The low-water theory, which is the most common one, is generally a cruel slander on the men who are not left to defend their reputations. The best informed engineers and scientists agree that the likelihood of explosion from low water is very remote in a locomotive boiler. Trials have been made repeatedly to explode locomotive boilers by heating them red hot and then injecting water into them; but they did not explode. The effect of the pressure upon the weakened sheet generally was to force the sheet through the ends of the staybolts, the holes acting as so many safety valves.

The Railway Master Mechanics' Association have had many committees investigating questions relating to the keeping of boilers free from accident, and the reports nearly always emphasized the importance of rigid and regular inspection, especially of staybolts. From the first day that a boiler goes into service the action of powerful forces is working towards its destruction; and it is only by care and vigilance on the part of those in charge, that the deteriorating agencies can be prevented from bringing the boiler to grief. The pressure within and the ever varying temperature keep up continual movement, and strains become concentrated at the weakest points and lines. The firebox is the cause of conflicting stresses that are difficult to hold in subjection. The heat of the fire keeps the firebox varying in length, the pressure of the steam inclines to tear the box away from the outside shell and acts to force the connecting sheets away from the mud ring. The principal obstacle offered to these destructive agencies are the staybolts. They form the principal safeguard of the boiler, and no care in application or vigilance in supervision ought to be spared in maintaining them at the highest efficiency.

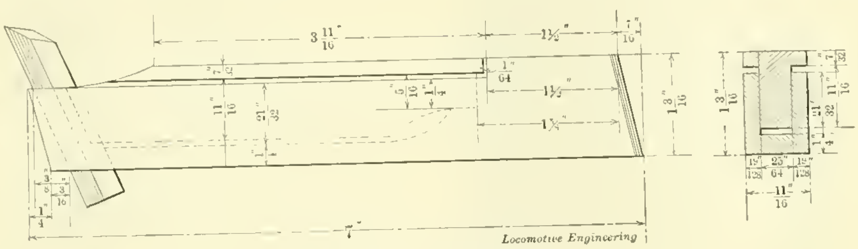
A committee of the Southern Railway Club, of which Mr. R. P. C. Sanderson was chairman, made a most thorough investigation on staybolt inspection a few years ago, and they took a very decided stand in favor of hollow staybolts, because these nearly always gave warning when a bolt broke. They also favored riveting over the hole inside the firebox, on the ground that the current of air passing in at the opening sometimes acted like a blow-pipe and heated the sheet around the staybolt to the extent of causing cracking. This fact does not seem to be generally known. The committee, a particularly able one, attached the greatest importance to regular and systematic practices of inspection to detect the presence of broken staybolts. Where solid staybolts are employed the safety of the boiler will always depend to a great extent upon proper inspection. There is great diversity of practice among railroad companies as to the frequency of inspecting staybolts and concerning the manner in which the work is done. On some roads the staybolts are supposed to be tested every time the boiler is cool enough for an inspector to go inside the firebox, on others it is done once a week. Once every two weeks is common, while other motive-power officials think once a month is often enough. Longer intervals between inspections are considered safe where the feed water is good. We think that the people who inspect the staybolts once in six months or longer take unjustifiable risks.

When engines are run hard, the inspection of staybolts is frequently done in the most expeditious manner—which is, sounding them when the water is inside. Sometimes it is done under pressure, but the men doing the work are not very particular. That is a slipshod, easy way of doing the work, and is next to neglecting it altogether. It is very difficult to detect by sound the condition of a staybolt, especially in water, for the water offers almost as solid a resistance to a slight blow as steel does. Every row of staybolts has its own particular sound, and this sound varies with the location of the staybolts in the rows. The sound of the staybolts in different locations differs as much as that between a cracked and a sound staybolt. A master mechanic of our acquaintance recently discussing the best method of testing staybolts, remarked that the best method was that which led to the most certain detection of breakage. We readily agree with that view, and we will add that it is unquestionably true that more broken staybolts can be found by sounding when a light pressure of 50 or 60 pounds of steam or air is used while the boiler is empty of water. In that condition there is nothing to deaden the sound, and it will be a poor inspector who fails to discover the difference in sound between an intact and a broken staybolt. That is the safe practice. It is not costly or troublesome to carry out, and therefore it ought to be adopted by all railroad companies.

Improved Tool Holder.

The convenient form of tool holder shown in the annexed engraving was designed in the Missouri Pacific shops at St. Louis. We are indebted to Mr. L. Bartlett, master mechanic of the road at St. Louis, for the blueprint from which the engraving was made. In sending the print Mr. Bartlett wrote:

"The tool holder proper is made of cast steel and in two pieces. The tool itself is made of ⅜-inch square steel in this instance, and of the self-hardening kind. It is held or clamped in by the screw of the tool post. Now, there are a great many so-called tool holders on the market, but, without exception, this is the neatest and best one that I have seen. One beauty of it is that you can put round steel in in place of the square if you choose, so as to make fillets or irregular shapes, and it holds the round equally as well as the square. We have tried the different tools now on the market, and we have found this superior to any yet experimented with. Mr. F. W. Roebbel is the designer and patentee of the tool."



IMPROVED TOOL HOLDER.

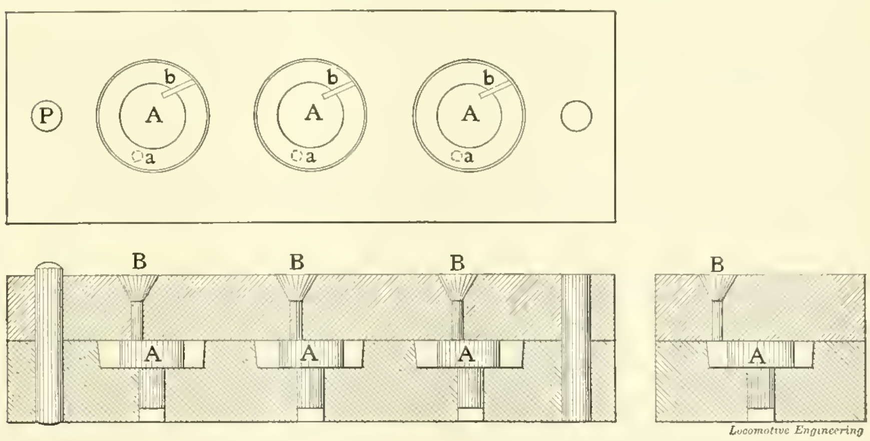
The Chicago office of the United States Metallic Packing Company, in charge of Mr. A. J. Zwart, has been removed from Marquette Building to 509 Great Northern Building.

Making Metallic Packing Rings.

Many shops make their own rings for metallic packing, and each has its own idea as to the best way of doing it. Our friend David Gibson, at Bridgeport, has a simple little rig for casting Jerome packing rings which is cheap and effective. It consists of two cast-iron blocks, placed where they come together and bored for the rings as well as the metal centers or cores. The gates come over the side of mold as seen in the end view, and after cooling a trifle the top piece is struck sidewise with a lead hammer, shearing off the gates. The lower half is held in a vise, and the dowel pin centers the block over the mold. The cores are then driven out, which loosens the rings, and the job is done, as they are so smooth that no machine work is done on them. This is for Jerome packing.

At the New Haven shops they have a very ingenious rig for doing the same work as well as casting United States rings. The main plan is the same as that of Mr. Gibson, but the idea has been elaborated considerably.

The cores are forced up by a movement of the upper or gate half of mold, and the gates are also sheared by the ingenious device shown. This consists of two cams on a handle, and in the position shown the upper cam locks the mold together. A turn of the handle moves the upper or locking cam away and brings the lower one against the handle, forcing it sideways and shearing the gates. They cast the rings with an offset lap joint here and claim better results than with the plain cut.



GIBSON'S MOLD FOR METALLIC PACKING RINGS.

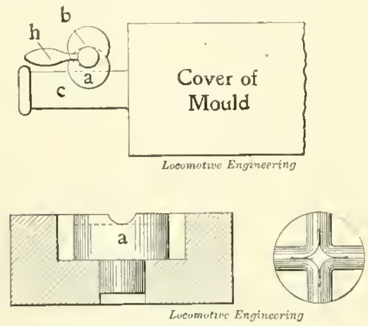
Mr. Butler, master mechanic at Valley Falls, R. I., pours his packing rings from the center and lets it flow from two or four points. The sketch shows the four-way center plug.

In this connection it is interesting to note that the experience of the United States Metallic Packing Company has been that it pays to finish the rings, instead of leaving them as cast. They are said to wear longer and give enough better satisfaction to pay the difference.

They make no secret of their mixture, which is 100 pounds of tin, 9 pounds of copper, 6 pounds of antimony. This is called number 1 mixture, and is used for their old style single angle rings.

The multi-angle enables them to use a cheaper mixture, which is 83⅓ pounds of lead, 8⅓ pounds of tin and 8⅓ pounds of antimony. This is called number 4.

That ever difficult question, "Where to go for a vacation?" again confronts us, and a most perplexing problem it is. Northern New England, without a doubt, offers a greater variety of vacation places, including lake, mountain and seashore resorts, than any other section of the country. The hotels of this region have no equal. The methods for amusement and recreation include everything that is desired, and the easiness by which the tourist can reach his abiding place is a feature which alone speaks for itself. A perusal of the "New Summer Resort and Tour Book" just issued by the Boston & Maine Railroad will help amazingly in selecting your summer outing place. The book has a list of a thousand summer hotels and boarding houses, together with maps, routes, rates and stage connections, and is sent to any address, free, upon application to the General Passenger Department of the Boston & Maine Railroad, Boston. Be sure you get it before you talk vacation.



BUTLER'S MOLD FOR PACKINGS.

A Sand Lifter.

Some two or three months ago an item was published in LOCOMOTIVE ENGINEERING calling for a device that would lift the sand out of a locomotive sand box in case the valves were disabled so the sand would not run out the usual way, through the sand pipes. It is a tedious job to bail the sand out clean through the opening in the top of the box, and more or less sand is usually spilled on the machinery below.

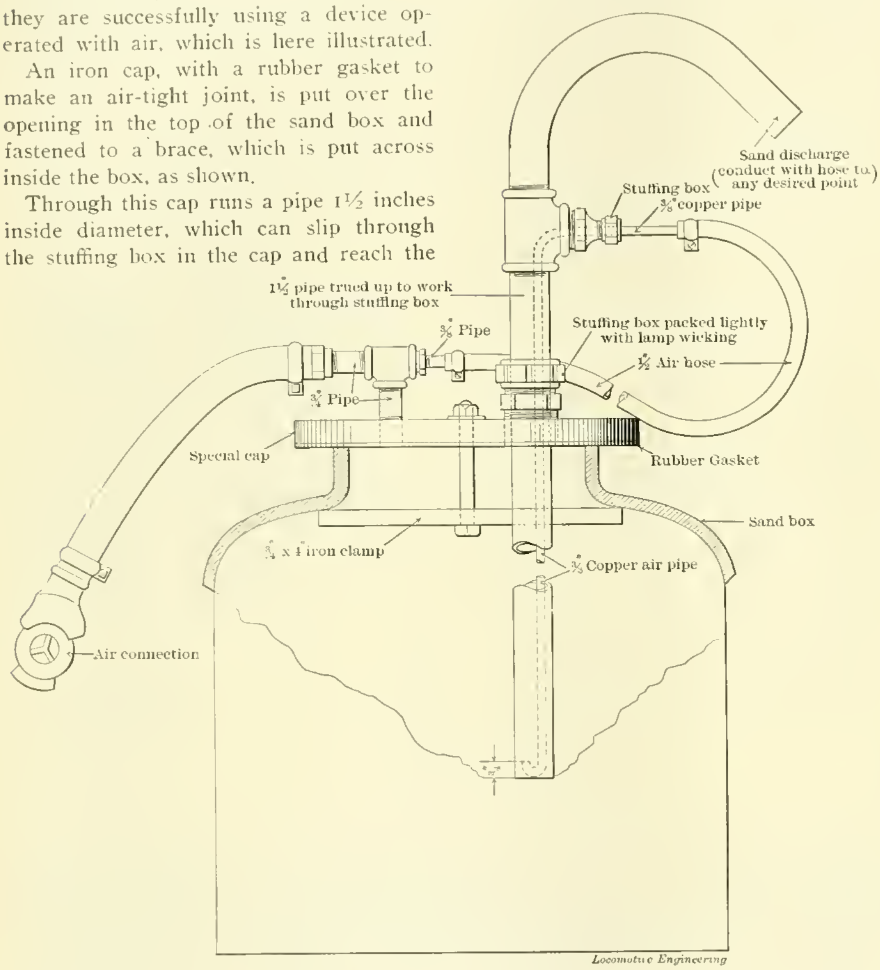
At Cleburne, on the Santa Fe route, they are successfully using a device operated with air, which is here illustrated.

An iron cap, with a rubber gasket to make an air-tight joint, is put over the opening in the top of the sand box and fastened to a brace, which is put across inside the box, as shown.

Through this cap runs a pipe 1½ inches inside diameter, which can slip through the stuffing box in the cap and reach the bottom of any of the sand boxes. An air hose connection furnishes air to the small copper pipe shown running down inside the 1½-inch pipe and turning up again at the bottom. This small pipe or "primer" keeps the flow of sand regular up through the large pipe and out of the box; a hose can be attached to the pipe and the sand delivered in any suitable place—in the sand box of an engine on the next pit if necessary. At the same time the air comes into the box through the ¾-inch connection shown, and with a very moderate pressure the sand flows out in a continuous stream. The "primer" seems to do most of the work.

In case the sand valves can be opened the sand soon starts through the sand pipes also.

We understand that an application for a patent on this device has been made by Mr. Thomas Butler, the inventor.



PNEUMATIC SAND-BOX CLEANER.

A Summing Up.

While the discussions in regard to "Why a Locomotive Goes" have been good as "think provokers," the question has been pretty well summed up by our friend Forney in his Catechism. He says: "The question whether the center of the axle or the point of contact with the rail is the fulcrum of the lever, has been the subject of much discussion and contention. As the word *fulcrum* means 'a point about which a lever moves,' it is believed that the dispute is due simply to a difference in meaning assigned to the word fulcrum. If we regard the fulcrum as the point which is fixed in relation to the locomotive, then it is at the center of the axle; but if we refer it to the surface of the earth, then it is the top of the rail."

This is a very good summing up of the case, and ought to satisfy almost anyone.

The positively safe lock of the Smillie improved freight coupler is being demonstrated in their new tender coupler, illustrated in this issue. This coupler cannot work open in transit. When the locking pin is up and resting on the tail of the knuckle, it shows at a glance that the coupler is ready for action; hence cars are quickly shunted. Its great simplicity and few parts expedite the work of car repairers. Railroad officials will do well to examine this coupling device.

A Circus Train Order.

We have been favored with a train order issued by the Great Northern, of England, regarding the movement of the great Barnum circus on that road. The cover is shown in miniature (the size being 8½ x 11 inches), and the instructions accompanying it cover three pages. It is the only thing of the kind we have seen, and we are indebted to Mr. E. G. Desoe, air-brake inspector of the Boston & Albany, for it.

Private, for the use of the Company's servants only.

GREAT NORTHERN RAILWAY.

Circular No. 12,808a.

REMOVAL
OF
Messrs. BARNUM & BAILEY'S
"GREATEST SHOW ON EARTH."

HULL (N.E.) TO BRADFORD,
Via STAINFORTH JUNCTION,
Night of SATURDAY, 17th SEPTEMBER,
AND
BRADFORD TO HUDDERSFIELD,
Night of TUESDAY, 20th SEPTEMBER, 1898.

CIRCUS TIME TABLE.

A Sign of Good Times.

Some of the old-timers can remember when the cabs of the engines were supplied with good spring cushions for the engineers' and firemen's comfort, as well as with good lamps, torches, etc., to aid them in their duties. We cannot say so much for the work done to make the fireman comfortable, for these engines had so much brass and "fancy fixin's" to be scoured that the fireman took very little comfort. He was so tired when he got her all shined up that he did not appreciate the cab fixtures.

Then the sheet brass came off, and black paint went on; so the engine took on a severely plain appearance. Then came the day of chain-ganging, or, as we call it nowadays, pooling, and the comfortable seats disappeared in short order. We think the men who would not take any care of anything they did not have an individual interest in, were to blame for the lack of comfortable seats.

We notice in our travels that the companies that used to furnish "standing room only" in the cabs are beginning to buy good seats and put them on all engines, whether pooled or individual engines. When these spring seats and good cushions are fastened to the cabs, so they cannot be changed from one engine to another or easily stolen, they usually remain there. Loose cushions do not.

This is a good sign; it shows that they

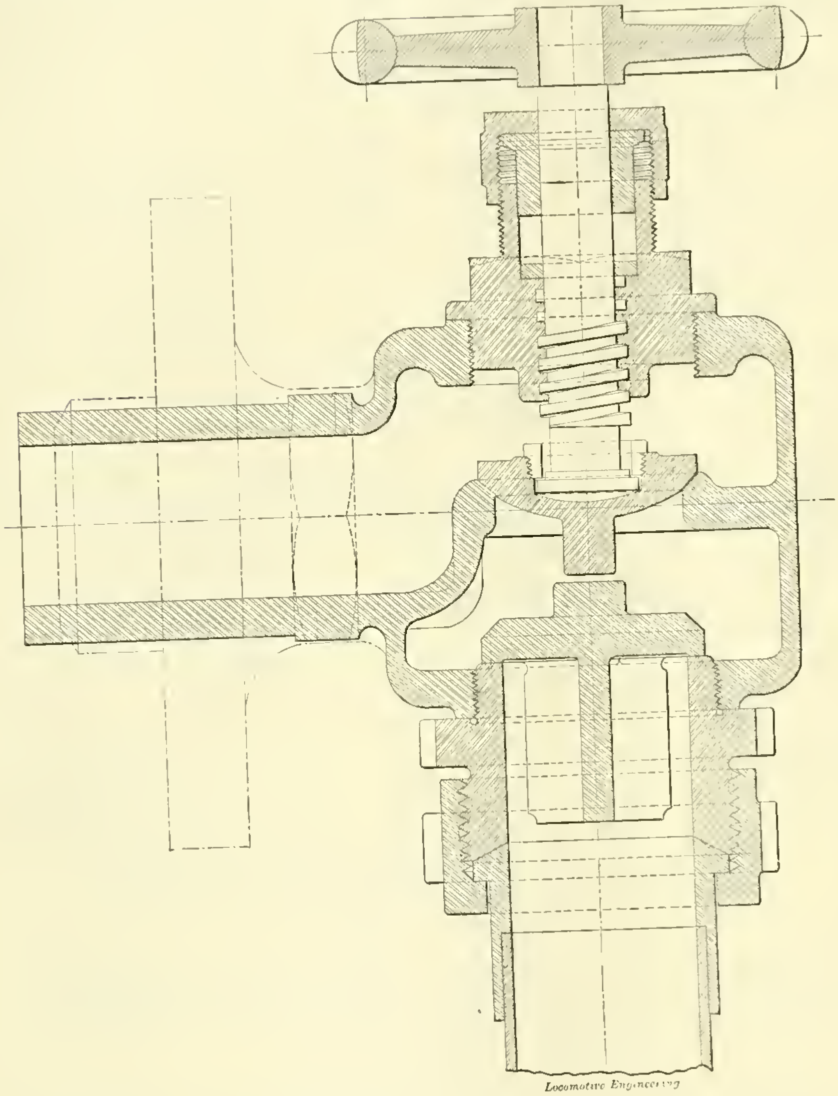
appreciate the fact that an engineman needs all his strength for his duties, and if forced to stand up or sit on a tool-box with a piece of carpet on it, he tires out long before the trip is ended, and does not do his best work. Good cab seats conveniently arranged cost more than poor ones at the first outlay, but they pay in the long run.

The claim is made that the men won't take care of them if the company puts them on, but enginemen are usually keen enough to help out anything that makes their work easier. The companies that have always given this matter their attention say that it pays.

Good seats do not add enough to the expense of a new engine to count for much. We are sure it will add to the care taken of them while in service.

New Cars for the Black Diamond Express.

The new passenger cars for the Lehigh Valley Railroad have been received from the Pullman shops, and were placed in service in the Black Diamond Express on May 27, the date the summer schedule took effect. These cars are without doubt more complete in detail and design and handsomer in finish than any cars ever turned out of the Pullman shops, and the operation of such cars in the Black Diamond Express between New York and Buffalo will improve the high standard of this service and will no doubt make it more highly appreciated by patrons.



COMBINED STOP AND CHECK VALVE.

Combined Stop and Main Check Valve.

In connection with the recent practice of some roads, doing away with boiler checks and depending on the line check, putting a stop valve next the boiler, the valve shown here will be of interest.

It is one of a lot of twenty-four made by William Sellers & Co. for the Schenectady Locomotive Works, who used them on a lot of engines for the Kiushiu Railway of Japan. They are for 2-inch pipe, and accompanied No. 8½ Sellers injectors on these engines.

As will be seen, the check has a flat seat and lies right below the stop valve seat. Closing the stop valve allows check to be taken out and ground at any time.

Electric Car Lighting.

There has been marked improvement in car lighting the past few years. Oil lamps for passenger coaches have been superseded by gas on most roads, and now gas has a competitor in the shape of electricity. After many years of experimenting, a system of electric car lighting was finally evolved and put into practical operation by several different companies. The one now being generally used is known as the "Axle Light" system, which embodies a simple, independent and complete electric car lighting equipment for each car. The electricity is generated from the car axle while the car is in motion, and is supplied from a storage battery beneath the car when it is stationary. A technical description of the mechanism of electric car lighting equipment is not intended, but the progress that has recently been made in the introduction and operation of this system of car lighting on the passenger coaches of some of the leading railway lines is worthy of attention. Quite a large number of passenger coaches of several railways are now being equipped with this system of electric lights and fans, and in every instance it is said to be giving entire satisfaction to all concerned. The system is self-regulating; or in other words, it is automatic. The cost of maintenance per car per annum is said to be less than that of other methods of car lighting.

The various companies that have for several years been engaged in the manufacture and sale of electric car lighting equipment have been, in the past few months, merged into the Consolidated Railway Electric Lighting and Equipment Company, of New York.

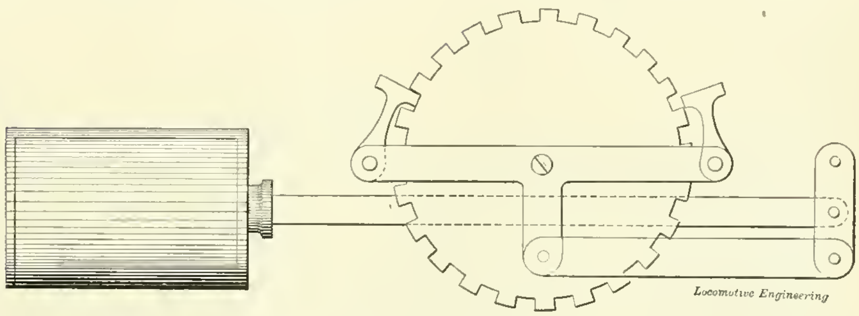
This company will have one of its complete electric car lighting equipments, including the use of electric fans as applied to a passenger coach or private car, on exhibition at Saratoga during the June meeting of the Master Car Builders' and the American Railway Master Mechanics' Associations, and the members of these associations are cordially invited to visit the car and make a thorough inspection and test of the equipment.

The Richmond Locomotive & Machine Works, Richmond, Va., are shipping, by Wilson Line steamers "Galileo" and "Colorado," to the Finland State Railways, Helsingfors, Finland, nine 16 x 24-inch ten-wheeled passenger locomotives with six-wheeled tenders complete. This is the second order shipped by the Richmond Works to the Finland State Railways, the first order being for seventeen engines.

An Air Helper for Valve Setting.

Many devices are in use for turning the wheels of an engine when setting valves, and another contribution to the list may be of service to some who are still doing it by hand. In this case it is a simple affair, consisting of the steam cylinder of a Westinghouse air pump, a few levers, a ratchet wheel and the necessary pawls.

These can be connected up in various ways; the sketch shows one of them we have seen. The pawls are thrown in and out by a lever which comes up through the floor, and of course the main wheels of engine rest on rollers which are on the same shaft as the ratchet wheel shown.



AIR HELPER FOR SETTING VALVES.

This is said to work very nicely and save lots of time—in fact, has reduced the cost of setting valves from $9 to $3 where it is used. It is controlled by a small thumb-valve mounted on a tripod over the main air valve for cylinder, as the large valve was not sensitive enough for small movements of the wheel.

The Philadelphia Pneumatic Tool Company reports a rapidly increasing demand for their tools. Their chipping and calking hammers seem to be particularly in demand, large orders having recently been received from the Pennsylvania Steel Company, Baldwin Locomotive Works, Brown & Sharpe Manufacturing Company, Ingersoll-Sergeant Drill Company, The Bigelow Company, and many other representative concerns. In all cases their hammers were adopted after severe competitive tests. This company have been obliged to more than double the capacity of their shops since the first of January. They have established agencies in all the leading cities of Europe, and also in Japan.

We have still a few bound volumes for 1899; price $3. Anyone desiring a copy would do well to order immediately. They are substantially bound in red cloth.

The Ingersoll-Sergeant Drill Company, New York, had all their air compressors at the Paris Exposition erected and ready to run on the opening day, being the first American exhibitors to operate and the first exhibitors from any country to run their exhibit by steam. Mr. John J. Swann, late associate editor of *Engineering News*, is in charge of this exhibit.

The Chicago Pneumatic Tool Company are preparing to give an elaborate exhibit of their pneumatic appliances at the convention of the Master Mechanics and Master Car Builders, to be held in Saratoga in June. Mr. J. W. Duntley, president of the company, who has been traveling in Europe the past several months on business of the company, will return to the United States in time to attend the Saratoga convention. The Chicago Pneumatic Tool Company are making a very extensive display of their products at the Paris Exposition.

The *Locomotive Magazine* for April, published by the Locomotive Publishing Company, 102A Charing Cross Road, London, England, is a particularly attractive number and contains a great variety of illustrations of modern and ancient rolling stock that railroad men find very interesting. The magazine costs only one dollar a year, and is well worth twice the money.

Mr. T. P. Kimman, assistant mechanical superintendent of the Standard Pneumatic Tool Company, has just sailed for Paris in order to install and operate the "Little Giant" pneumatic tools and appliances at the Paris Exposition. A complete air plant will be in actual operation in the Champs de Mars and Park Vincennes, demonstrating the adaptability of pneumatic tools to various classes of work, and showing the development of this class of machinery. It will be a novel and interesting exhibit and one that will redound to the credit of America.

We have received from Mr. P. S. Eustis, general passenger agent of the Chicago, Burlington & Quincy Railroad, a book just off the press, which is unusually interesting and artistic. It is on the subject of Colorado, fascinatingly written by James W. Steele, a descriptive writer of great force. The book is lavishly illustrated by engravings of a high order, and the printer's art has not been handicapped by an effort to save expense. To anyone interested in the grandeur of Colorado scenery, and particularly to one contemplating a visit to the country described, the book will be indispensable. Copies can be had by sending a letter of request accompanied by six cents in postage stamps to Mr. Eustis, at his Chicago address, 209 Adams street.

At the May meeting of the Western Railway Club the following officers were elected: A. E. Manchester, president; Prof. Goss, first vice-president; J. F. Deems, second vice-president; P. H. Peck, treasurer; R. D. Smith, G. R. Henderson, F. W. Sargent, Board of Directors; F. W. Sargent, Wm. Forsyth and F. A. Delano, Board of Trustees of D. L. Barnes library.

The first number of the Boston & Maine "Messenger" has been received, and is nicely illustrated with scenes of the attractive places that abound along this line. It will be issued monthly for free distribution from the Passenger Department, Boston, Mass., and we advise everyone desiring a copy of this interesting monthly to send for one.

The New York Air Compressor Company have received, through the Chicago Pneumatic Tool Company, an order for a compound steam-driven compressor to furnish 1,500 cubic feet of air per minute for the motive-power department of the New York Central & Hudson River Railroad. The Compressor Company are also building a large compressor to be placed in the Grand Central Station for the operation of pneumatic signals.

CONTENTS.

Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock

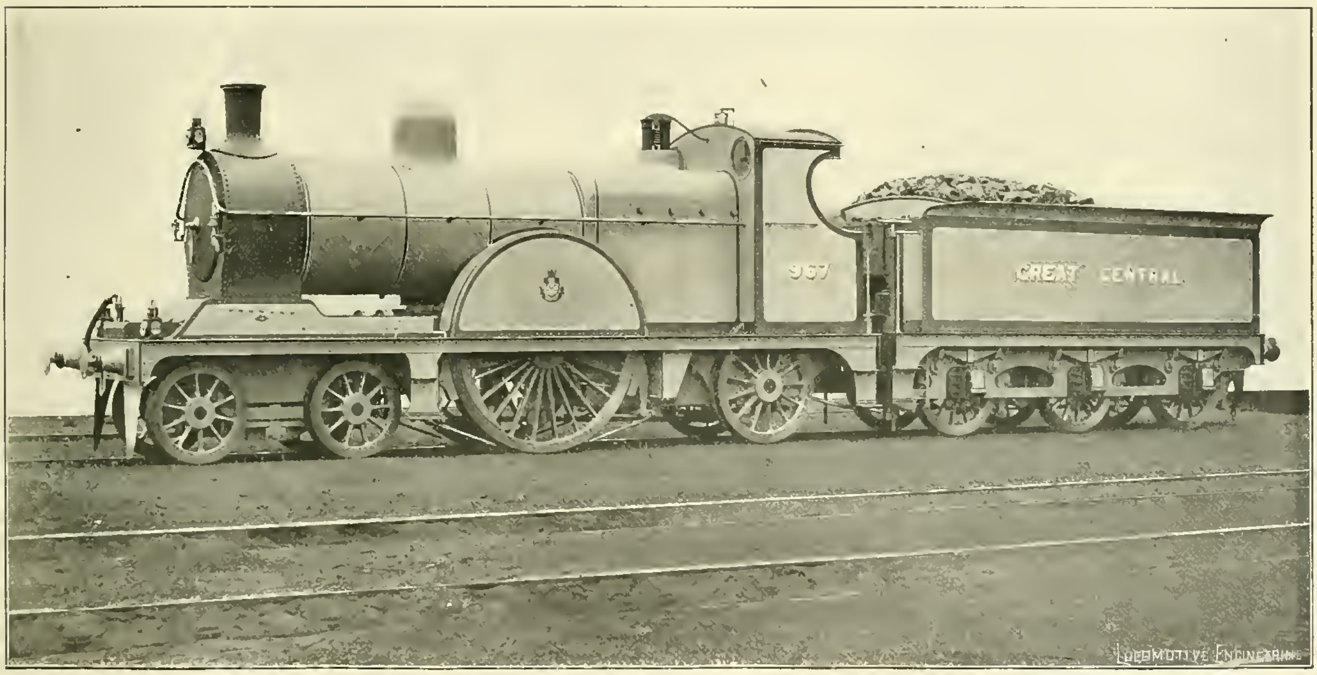
Vol. XIII 95 Liberty Street, New York, July, 1900 No. 7

Great Central's New Single Driver Engine.

The handsome express engine with single pair of driving wheels herewith illustrated is the latest form of fast passenger locomotive designed by Mr. Harry Pollitt, locomotive engineer of the Great Central Railway of England. We are indebted to Mr. Pollitt for the excellent photograph from which the engraving is made.

The engine has a remarkably smooth appearance, and will, no doubt, do fast running when the train is within its capacity. We supposed that the time of single driver engines had passed with the advent of the hard-pulling vestibule train, but Mr. Pollitt no doubt has service where this engine will do the work better than those with coupled drivers. The cylinders are 19½ x 26 inches, and the driving wheels 93 inches in diameter. As the boiler carries 200 pounds per square inch, the engine develops considerable tractive power even with the enormous diameter of drivers. Figured by the Railway Master Mechanics' formula, the tractive power for starting is about 18,000 pounds, which is nearly half the total weight on drivers to provide adhesion.

The boiler is of the Great Central Railway standard, with Belpaire firebox, the center line being 8 feet 2 inches above the rail. The diameter of the boiler at the smallest ring is 51 inches, and the length between tube plates 11 feet 2 inches. The firebox is 8 feet long and 4 feet 1 inch wide outside. There are 200 1¾-inch tubes. The total heating surface of the boiler is 1,194 square feet, and the grate area is 24 square feet. The total weight of the engine is 105,000 pounds, 40,320 of that being on the drivers and 36,500 on the leading truck. The total length of engine and tender is 54 feet 9 inches.



Harry Pollitt, 1900.

A MODERN SINGLE DRIVER ENGINE.

A College Professor Who Reads Locomotive Engineering.

At the May meeting of the Western Railway Club Prof. L. P. Breckenridge presented a paper on "Locomotive Road Tests. How Should They Be Made?" In the discussion that followed the reading of the paper, our chief editor expressed the opinion that the paper called for too much elaboration in carrying out tests of locomotives. In replying to the criticisms Prof. Breckenridge, among other things, said:

"I did not know that Mr. Sinclair would be here, but I am glad that he is. I put in this sentence, thinking of him, but not expecting that he would be here: 'There are many experienced railroad men who do not believe that road tests should be made at all.' I actually thought of Mr. Sinclair when I wrote that sentence. I did so because I have watched his remarks for a good many years with interest, and I knew what he thought about it all the time, and it has not been my object to prove that road tests should be made, but if anyone has any reason to make them, here are some suggestions."

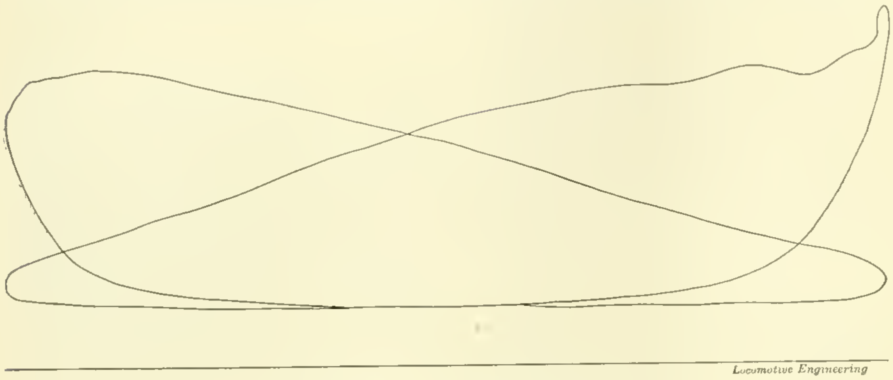
In reply to this Mr. Sinclair said: "I am sorry if I gave the impression that I am opposed to road tests. In fact, I am much in favor of them, but what I object to in the operations that are recommended by various parties in making the tests is that they make the tests so difficult to carry out that they are not done. What we need is a few simple operations which two or three men can carry out, so that the engines can be attended to in the way that the tests indicate to be necessary."

Effects of Bad Valve Setting.

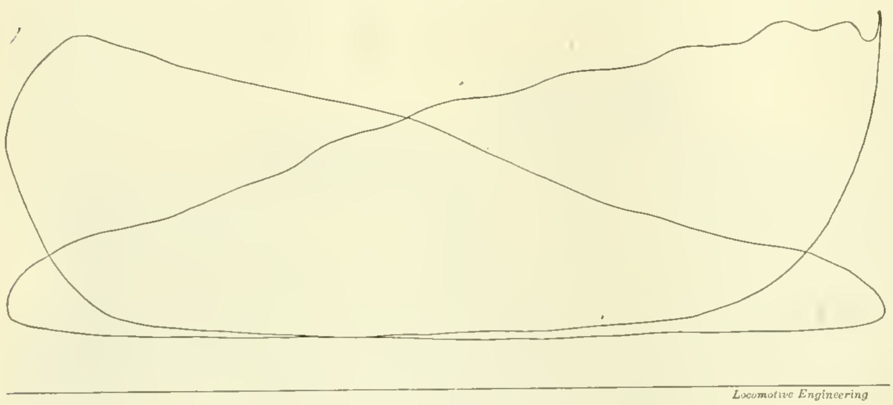
The indicator diagrams here shown are selected from a collection sent to us by Mr. G. W. Wildin, mechanical engineer of the Plant System at Savannah, Ga. They show very clearly the loss of power due to the admission of steam being delayed at the beginning of the stroke and the improvement effected when the valves were properly set. About the circumstances that led to the diagrams being taken, Mr. Wildin writes:

"During the early part of February, 1899, engine No. 519, from which these cards were taken, collided with a large tree which had been blown across the track during a severe wind storm. The engine was going at a speed of about sixty miles an hour when the accident occurred. At the conclusion of the melee the engine was found several yards to one side of the track on her side, buried in the sand, void of all outer trimmings, with one link, link-hanger, etc., completely demolished. After the resurrection she was taken to the Montgomery shops and given a general overhauling, a new link being applied and the valves set or adjusted in the usual manner with the trams. When the engine was again placed in service, the reports of those in charge seemed to indicate very satisfactory performance.

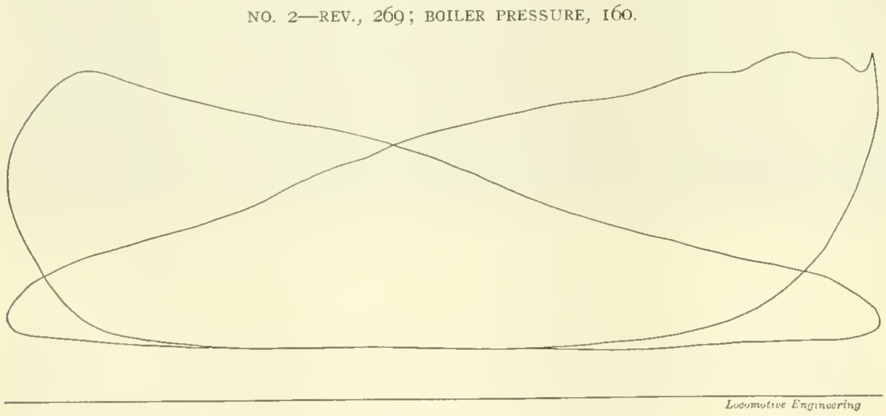
"In this connection, however, it might be well to note that this being a 19 x 26-inch cylinder engine, with 69-inch driving wheels and a boiler carrying a pressure of 180 pounds per square inch, pulling only a five and six-coach train at moderately slow speed, was not taxed to its utmost capacity; consequently the reserve power, in a measure, compensated for the poor valve adjustment. Under such circumstances, during the busy season of the year, it is quite natural that the attention of the mechanical staff was not attracted by the poor adjustment of the valve gear.



NO. 1—REV., 293; BOILER PRESSURE, 170.



NO. 2—REV., 269; BOILER PRESSURE, 160.



NO. 3—REV., 220; BOILER PRESSURE, 165.

"I was instructed by Mr. W. E. Symons, superintendent of motive power, to arrange to place the indicator on this engine, which is one of a class of six operated on the Alabama Midland division. The idea was to adjust the valves on this one properly, and then duplicate the measurements as much as possible on the other five of the class.

"Cards Nos. 1, 2 and 3 are the products of the first trial, before any attempt was made to adjust the valve gear. Cards Nos. 4, 5 and 6 are what I call the finished product. They are the result of the last trial.

"Both sets of diagrams were taken between Thomasville, Ga., and Montgomery, Ala., and were taken going in the same direction over the division, with the same total tonnage. The train hauled consisted of five vehicles, the total weight of which would be about 160 tons. The engine weighed, in working order, 115 tons, making the total weight of engine and train 275 tons. From Thomasville to Montgomery is a distance of 211 miles.

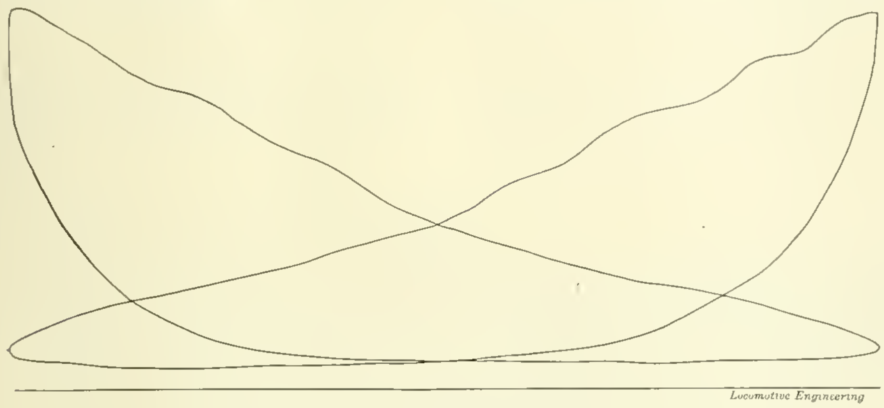
"During the trip cards Nos. 1, 2 and 3 were taken we consumed between points 7 hours and 5 minutes. From this we will subtract 45 minutes for delays, leaving the running time 6 hours and 20 minutes, making the average speed of nearly 33.5 miles per hour. We used on this occasion 9,520 gallons of water and 6 tons of coal. This would be an average of 35 miles per ton of coal and an evaporation of 6.6 pounds of water per pound of coal.

"On our last trip, when cards Nos. 4, 5 and 6 were taken, the time between points was 6 hours and 5 minutes. Subtracting 1 hour and 15 minutes for actual delays, we have for running time 4 hours and 50 minutes, an average speed of 43.6 miles per hour. We consumed during the trip 9,680 gallons of water, and 6 tons of coal. As before, we have 35 miles for each ton of coal, and an evaporation of 6.7 pounds of water per pound of coal. We note at this point that while the speed was increased nearly 25 per cent. on the average, the fuel consumption, as well as the quantity of water used, remain a constant.

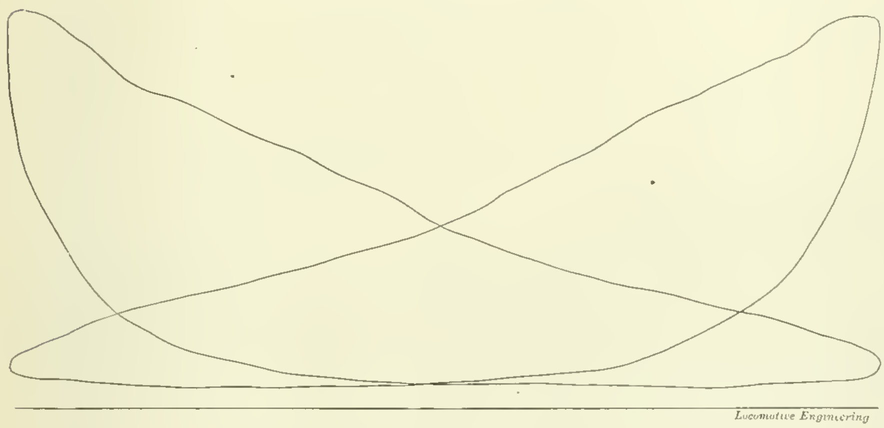
"The burning question of the day seems to be, 'What does it cost to run trains at high speed?' We might ask the question, 'What does it cost to run trains at moderate speed, with the present loose methods of adjusting the valve gear?' We cannot hold the valve gear adjustment, however, responsible for the saving of the whole of the 25 per cent., as a glance at cards Nos. 1, 2 and 3 will instantly reveal something radically wrong with the counter pressure line. The back pressure on these cards runs from 22 to 27 pounds, while on card No. 4 it is about 10 pounds. This reduction of back pressure was brought about by enlarging the tip of the exhaust nozzle from 4¾ to 5¼ inches.

"Besides gaining a great deal in the efficiency of the engine, we gained also in its comfortable working. Before adjusting the valves the engine was sluggish in getting started, usually requiring the slack to be taken in, in order to start the train. This difficulty entirely disappeared after setting the valves, as shown by cards 4, 5 and 6.

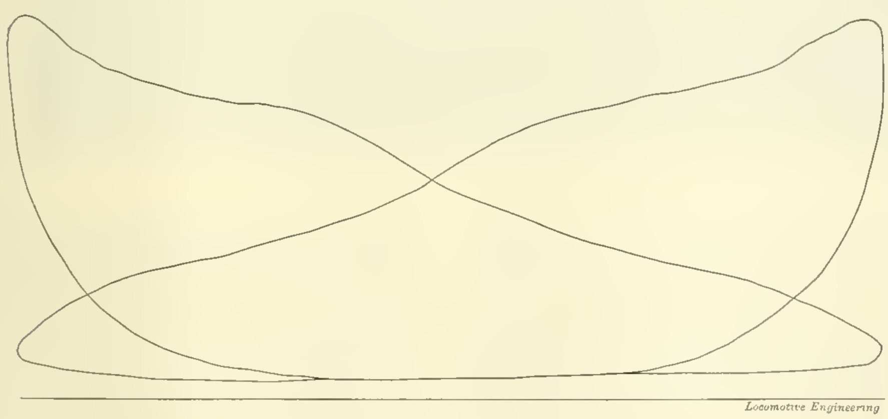
"The following comparison of the two sets of cards will reveal their points of likeness and difference:



NO. 4—REV., 298; BOILER PRESSURE, 160.



NO. 5—REV., 269; BOILER PRESSURE, 160.



NO. 6—REV., 220; BOILER PRESSURE, 150.

	Miles per hour.	Average M. E. P.	Cut off.
Card No. 1.......	60	59.8	....
Card No. 4.......	61	57.0	8½"
Card No. 2.......	55	76.0	....
Card No. 5.......	55	63.0	8½"
Card No. 3.......	45	71.2	....
Card No. 6.......	45	77.0	10½"

The scale of spring was 80 in both cases. It will be seen that cards Nos. 1 and 2 show a higher mean effective pressure than cards 4 and 5, of about the same speed, and yet cards 1 and 2 have an excessive back pressure. It is unfortunate that the cut-off was not noted when cards Nos. 1, 2 and 3 were taken. The increase in mean effective pressure in the case of cards 1 and 2 can be accounted for in this way: The engineer was accustomed to working the reverse lever in a certain notch over a given portion of the road. After taking cards 1, 2 and 3, it was evident that the valves needed adjusting, so the engine was placed on rollers for that purpose. I concluded to graduate the reverse lever quadrant and stencil each notch with the proper cut-off. This was done while the engine was on rollers, the trams being used to catch the different points.

"Before doing this, however, I tested the length of the reach rod, and found it ¾ inch too long. I had it shortened and the quadrant stenciled. From force of habit the engineer continued to use the same notches in the quadrant that he used before the rod was shortened, consequently he got a shorter cut-off after the change by about ¾ inch, which is in this case equivalent to one notch. This will explain some of the funny things you see.

"Upon examining the valve gear after taking cards 1, 2 and 3, we found that the machinist who marked the valve stem had made an error in getting his points. With the old marks on the valve stem the trams indicated a very good adjustment, but when we gave the stem the proper marking and ran the valves over we found them as follows:

"Forward motion full gear front port 1-32 inch blind.

"Forward motion full gear back port, ⅛ inch blind.

"To produce such cards as Nos. 4, 5 and 6, we gave the valve the following adjustment: Lead in full gear, 1-32 inch; lead at 7 inches cut-off, 9-32 inch.

"It is our custom in setting valves to blind the back-up motion to reduce the lead when the engine is working at short cut-off.

"We are also inaugurating something in the construction of new valve gear, which many people call too technical; that is, we have the saddle pin on the links located in such a manner as to allow of a little longer cut-off at the piston-rod end of the cylinder than at the other, to compensate for the reduction of area of the piston due to the piston rod. You will notice in cards 4, 5 and 6 quite a uniformity when you compare the two ends. The engine from which these cards were taken is constructed as above."

To Refuse Cars That Have No Automatic Couplers.

The Wabash officials have issued a circular to car owners which reads:

"In anticipation of the enforcement of the United States laws governing the use of automatic couplers on cars of every character and description used in interstate traffic, on and after August 1, 1900, and appreciating the impracticability of separating equipment for use into state and interstate business, this company, in accordance with the recommendation of the American Railway Association, gives notice to all connecting lines and all private car owners that after June 1, 1900, no car not equipped with automatic couplers, whether belonging to a railway company or to private owners, shall be loaded except in the direction of home; and that from that date all such cars shall be returned so as to reach their owners before August 1, 1900.

"After August 1, 1900, cars not equipped with proper automatic couplings cannot be accepted by this company under any conditions."

Other railroads are issuing similar notices, and it will soon be a hard time for the roads that have put off the day of putting on safety appliances in hopes that something would turn up to put off the day of reckoning.

The Lackawanna-Nickel Plate Route.

The route between New York and Chicago by way of the Lackawanna and the Nickel Plate route is growing in popularity. It takes people through some of the finest scenery in America, over splendid roadbeds, in excellent cars that are noted for their fine riding qualities. The dining car service is worked on the principle of order what you want and pay for nothing else—a plan that is very popular. A curious thing about this system is that the ordinary traveler will often pay 50 per cent. more for his meal than he would under the hard and fast dollar-a-meal plan. Another curious thing about the advertising of the two roads for patronage is that the Lackawanna advertises their trains as being free from smoke, dust or cinders, a claim that is well founded, while the Nickel Plate passenger department publishes a conspicuous poster in which the heaviest clouds of black smoke are seen pouring out of the smokestack of the locomotive and enveloping the train. From what we saw during two trips recently made over the Nickel Plate, we think the designer of the poster slanders the road. The trains were nearly as free from smoke as those of the Lackawanna.

That Wind Splitting Train.

The experiments now being made on the Baltimore & Ohio Railroad have attracted considerable attention, and the photographs shown are interesting. The strange thing is that the engine has no razor-like appendage, the entire attention being given to the train.

The cars are old ones, with four-wheel trucks, but are being tested against similar cars, so there is no discrimination.

Mr. Adams, the experimenter, estimates that there are 600 square feet of resisting surface to a train of six cars—100 square feet to a car. The basis for this assumption is not quite clear.

He states that at a speed of sixty miles an hour the pull due to this would be 10,800 pounds, which is based on the pressure of 18 pounds per square foot at this speed. This would call for an engine of 1,728 horse-power without allowing for axle friction. According to our calculation, this is entirely too high.

Using the usual formula for train resistance, we find that a train of this kind and six cars at 30 tons each and a 60-ton engine, 240 tons total load, to require a pull of 5,300 pounds—less than half of Mr. Adams' estimate. Tests on the Northern Pacific Railway with speeds up to thirty-five miles an hour show even less resistance than the calculations given.

There is little doubt that the shields used by Mr. Adams will reduce train resistance to a limited extent, but we are confident that the saving is so small that the extra expense is entirely unwarranted. The most resistance comes from wind at the side and quarter, and with these the shields only increase surface exposed, although it must be admitted that it presents a more regular contour to the wind. We cannot help feeling that the experiment is doomed to failure when dollars and cents are carefully considered.

ADAMS WIND-SPLITTING TRAIN ON THE BALTIMORE & OHIO RAILROAD—FRONT VIEW.

Advertising the Other Fellow's Goods.

By one of the unaccountable happenings which seem to crop out in all kinds of business, and is usually laid to the office boy or the cat, the advertisement of the Crosby Steam Gage & Valve Company, in June, contained a cut of another maker's steam gage.

While it is bad enough to appear to be copying another's device, it is worse to advertise his goods in your space, and the Crosby Company naturally wish to be set right in the matter, although no one who knows them would think for a minute that they needed or intended to copy a steam gage or anything else.

"Paris Exposition—Special Edition" is the title of the latest catalogue of the Standard Pneumatic Tool Company, of Chicago and New York. Various interesting applications are shown, and cuts showing parts are given to assist in ordering.

Piston Rod and Valve Stem Packing.

BY C. B. CONGER.

"When was metallic packing invented?" you ask. Close to one hundred years ago, at the same time that James Watt was perfecting the double-acting condensing engine. Other inventors were working at the high-pressure engines. One of them, named Perkins, had one running using steam at 1,000 pounds per square inch. Of course, any vegetable fibre like hemp would burn out at once at that high pressure, for with a high pressure, steam has a high temperature also. In the high-pressure engines of Perkins and others used at that early day, a metal like babbitt metal was used with very good results.

Most of the rod packing at that time was hemp, which served a good purpose. The steam pressure was low and the piston speed very moderate, so hemp did not wear out very fast. As long as the steam pressure remained below 120 pounds the temperature was low enough for hemp to last, but as the pressures were raised from year to year, till they got up to 180 and 200 pounds in the locomotive service, the limit of endurance for hemp was passed.

Since metallic rod packing was first designed inventors have been devising new kinds, till they are as numerous as the various kinds of safety car couplers. Each inventor noted a special defect in some make of rod packing, and at once set to work to devise a form of packing to cure that defect. Each kind, when new and taken care of by its inventor, was O. K., but when it passed from his charge and had to get along on its own merits many of them were thrown out of service.

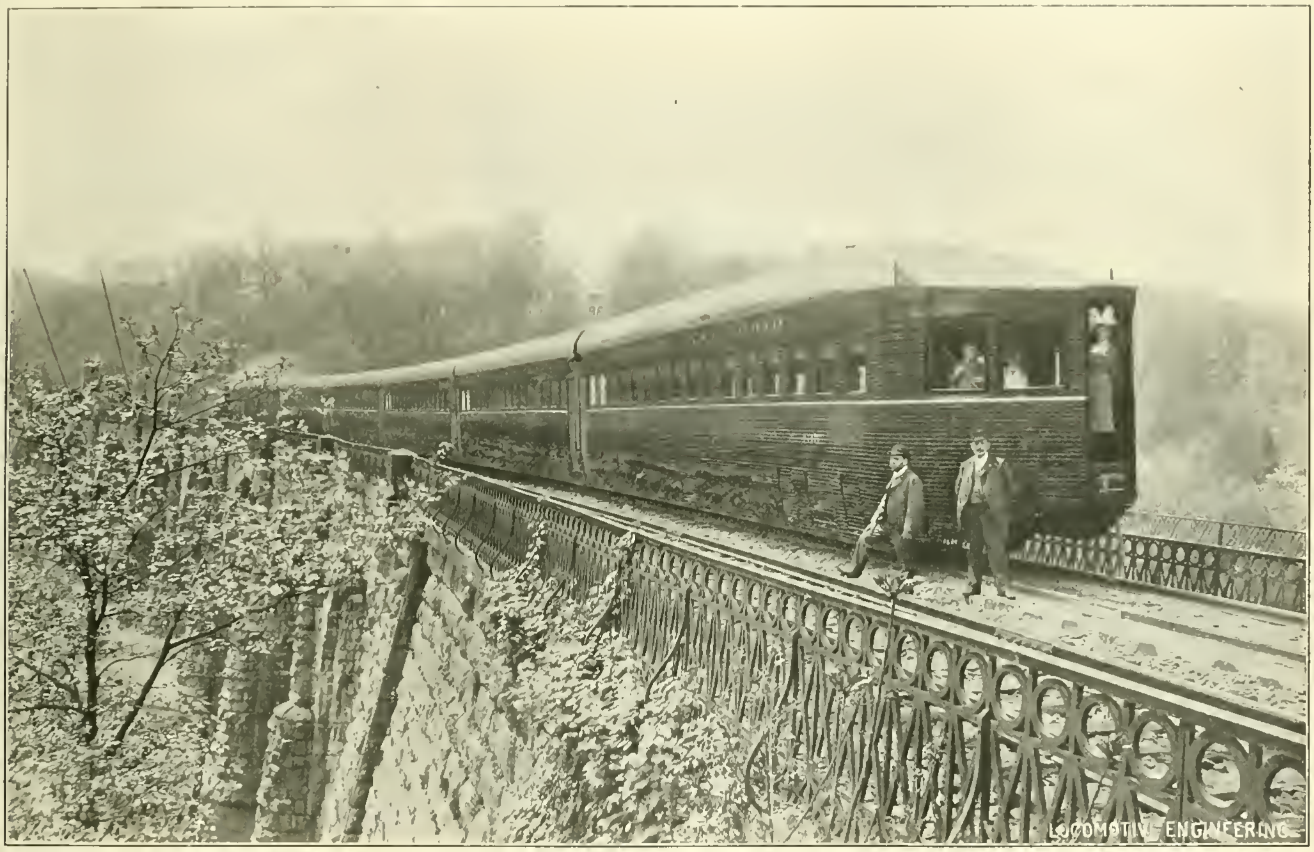
There are two general types, the one consisting of metallic rings which go around the rod, breaking joints so that the steam cannot pass the joints of the rings along the rod, and fitting into a conical cup that crowds the rings against the rod. This type usually has a strong coiled spring, which holds the rings in the cup. Steam pressure also tends to crowd the rings into the cup. This cup must be arranged for lateral motion of the rod, so the rings can follow the rod whether it moves sideways or up and down.

Another type has several sets of rings fitting around the rod and against each other on the sides. These rings are held against the rod by springs on the outside, compressing them towards the center.

A very common type of home-made packing consists of conical rings set with the taper faces meeting each other, so that closing up the gland would crowd the inside rings against the rod. This kind of packing does not allow for any lateral motion. Unless the crosshead was carefully lined up its use was confined to valve stems and air pumps.

Metallic packing requires considerable care after it is put in service. You cannot put it in and expect it will take care of itself till it is completely worn out, like a brake shoe.

You will notice when metallic rod packing is first adopted on a road where hemp has been exclusively used, that it gives more or less trouble till the men, both repairers and engine men, learn how to take care of it. The packing needs lubrication between the rings and the rod. If the oil could be introduced into the steam space next to the rings and right on the rod, it would be more effective than when a swab or oil cup is used outside the gland. Oil is needed more when the engine is drifting with steam shut off than when working steam. When it gets dry it soon gets hot and welds the rings together solid or melts them out. When the packing is put in the rings should break joints so the steam cannot pass through them. If it gets loose afterward, the rings may work around. If the spring used to hold the rings up close together is too weak, or breaks, the rings will pull out of their places along the rod till the spring can stop them, when they will go back with a snap. This is liable to break them. If the rod is not true from end to end, this will also be the case. A fin coming out from a ring along the rod is not always a sign of soft metal. The rings may have got dry, when the metal soon gets hot enough to flow out a little. It never pays to use a poor article of metal in the packing rings because it is cheap. It is the dearest in the long run. Lead packing



ADAMS WIND-SPLITTING TRAIN ON THE BALTIMORE & OHIO RAILROAD—REAR VIEW.

wears out the rods very fast; do not use it if possible to get metal with tin in it.

Valve stems wear faster on the bottom than on the top or sides, on account of the weight of the rod and valve yoke resting on the packing. Look out for this trouble when valve stem packing begins to blow through.

There are several compositions of asbestos and rubber, with some plumbago mixed with it, which when screwed up tight is almost as hard as any metal used for packing. As it has no elasticity, it needs very careful treatment, and after it gets solid it will stand a regular feed of oil. For air pumps which set upright so there is no lateral motion, asbestos does very well. For valve stems or locomotive piston rods, it must be used with some other material to give good results.

Where the bushing ring at the bottom of the stuffing box is worn out, so hemp packing pulls through into the cylinder, a ring of ¾-inch lead pipe put in at the bottom works fairly well. The pressure of the packing flattens it out, so it will fill the space between the wall of the stuffing box and the rod and keep the packing from pulling through next the rod. If you try this, don't be surprised when you find lead in the back cylinder cocks.

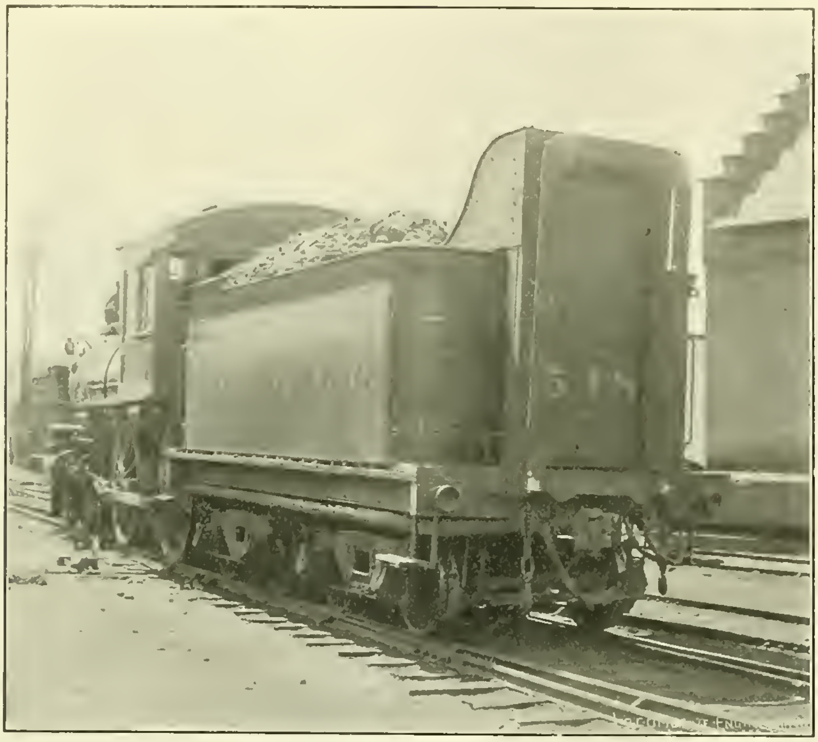
No. 3 shot make good metallic packing for an air pump. Put a turn of asbestos cord in the bottom of the stuffing box, then fill in full of the shot, and a turn of asbestos next the gland makes it all secure. Screw it down lightly; the shot will flatten next the rod and also mash into each other, making the spaces between them so small that steam will not work past them. Shot packing works better in the steam end than in the air end, probably because they are wet all the time in the steam end. To get the shot in the steam end of a Westinghouse pump, make a little bag of thin cloth and put them in with it. Be sure and fasten the gland so it cannot work loose, and tighten it up only a very little at a time. If you will wind bell cord around the piston rod till it fills in tight between the upper and lower gland nuts, they cannot work loose, and the bell cord makes a first-class swab; you can oil it easily.

"What will we do when a stud or gland breaks with metallic packing?" you ask. In some cases the gland can be wedged or blocked so as to hold it in its place when a stud breaks, at other times it cannot. In many cases it is necessary to take out the spring and packing and fill the gland and stuffing box with hemp if you have it, or a rope twisted from cotton waste. This can be held in with the other stud and plates of iron across the head or chest to some place handy to fasten it to. Most of the cases call for disconnecting if the gland breaks off when the engine is running. A valve gland can be braced with a stick from some handy part of the engine—the guide yoke, for instance.

"How will you cramp the valve stem to hold the valve still after you disconnect, with metallic packing?" you ask. Well, most roads furnish a bracket which fastens on one of the studs and is the right length to fasten to the valve stem or spindle where it joins the valve rod. If you cannot find this on the engine, cut a block the right length to hold the valve stem from going back into the chest, and put it between the chest and the connection to the rod; then fasten the rod by a brace to the run board so it cannot work out any farther. If the valve stem is still fast to the rocker arm, block the top of the rocker arm. Remember that the steam pressure in the chest tends to work the rod out of the chest and uncover the forward steam port.

Some metallic packing has a brass set screw, which goes through the outside end of the gland and reaches the stem. This set screw can be turned down on the stem and hold it solid.

Better figure out how you will fasten the valve before you break down, then maybe you will be ready when the time comes to know how.



VESTIBULE HOOD USED ON THE QUEEN & CRESCENT PASSENGER ENGINES.

Vestibule Hood.

The Cincinnati, New Orleans & Texas Pacific Railroad, better known as the Queen & Crescent, have adopted a novel form of hood for protecting the front vestibule of a train from cinders and dirt.

Most roads have a shield made of sheet metal which is fastened to the car vestibule and does the work very well. It is rather unsightly at times, and has to be changed from car to car as well as being fastened by clamps or bolts.

This device is built on the tenders of passenger engines, and, as will be seen, is always ready to back up against a vestibule of any car at any time. It costs a little more, of course, but it has a business-like air about it that attracts attention, and no time need ever be lost at terminals on that account. We were favored with the photograph by Superintendent H. M. Waite, of that road, but do not know positively who designed it.

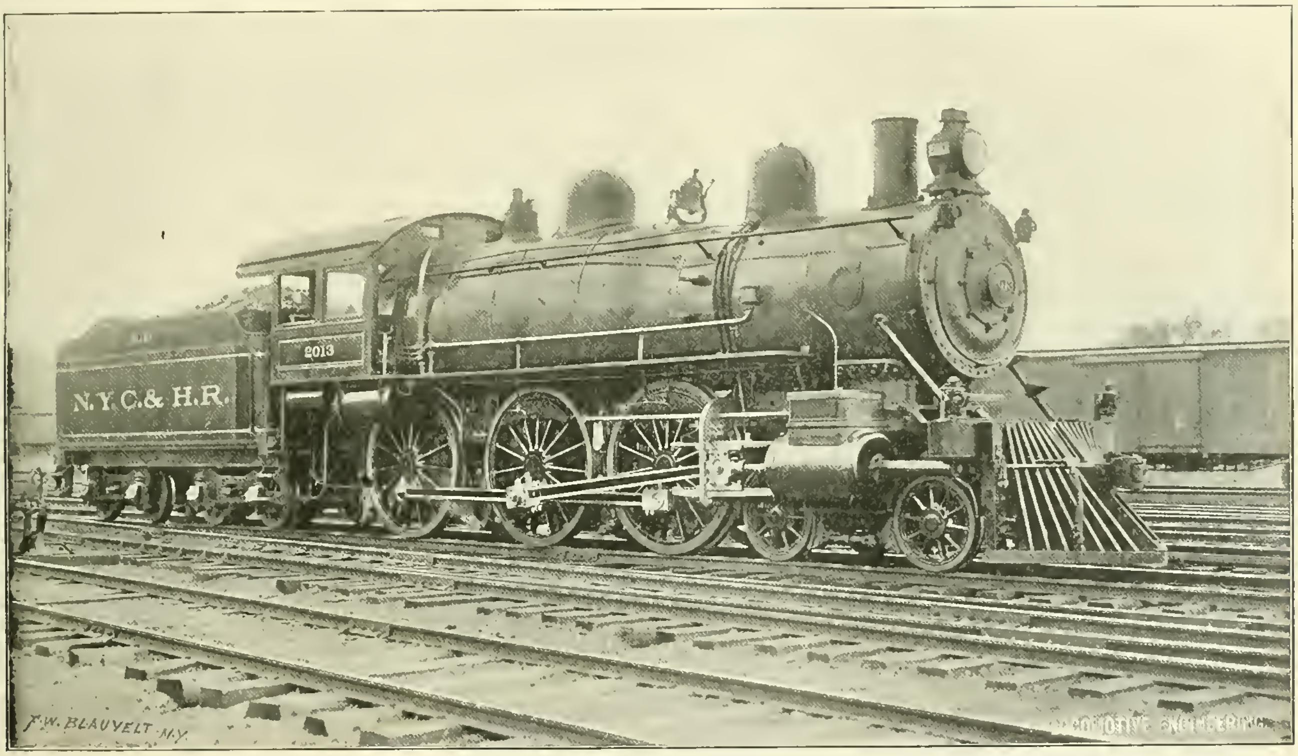
Railroad men are apt to look on a canal as a slow method of doing business, and a wreck anywhere around a canal as a very mild sort of an affair. But if the plans of the dynamiters who tried to destroy the gates of one of the locks in the Welland canal lately had been successful, the damage done by the water set free would have been tremendous. The gates that were damaged by the dynamite were at the top level of the canal, so that they held back the water of Lake Erie. If these gates had been destroyed, an immense body of water would have been free to rush down against the next set of locks and gates. These would have been swept away, and so on down the canal; while the banks would have soon given way and allowed the water to ruin the farms. The Johnstown flood would probably have been equalled. A railroad wreck is bad enough, but it is confined to a small piece of ground; all outside of that is left in good order. A bad canal wreck may ruin whole townships.

New York Central Baldwin Ten-Wheeler.

The New York Central people have adhered with great tenacity to the eight-wheel locomotive for hauling their fast express trains; but they have lately bowed to the inevitable and adopted ten-wheelers for the heaviest trains. The engine shown in the annexed engraving is one of a group of ten-wheelers built by the Baldwin Locomotive Works for the road. For the excellent photograph from which the engraving was made we are indebted to Mr. F. W. Blauvelt, a skillful amateur, whose work has frequently adorned these pages.

The engine has cylinders 20 x 28 inches, the driving wheels are 75 inches outside diameter, and the boiler carries a working pressure of 200 pounds to the square inch. The weight on drivers is 134,200 pounds. The tractive power of the engine, worked up from the data mentioned, is a little over 25,000 pounds, and the ratio of adhesion to traction is almost 5. The boiler is 67 inches diameter at the front ring; there are 2,915 square feet of heating surface in tubes and firebox, and there are 30.5 square feet of grate area. The boiler contains 366 2-inch tubes 14.4 feet long. The total weight of the engine is 175,000 pounds, of which 134,200 pounds are on the drivers and 40,800 pounds upon the truck. The driving-wheel base is 14 feet 11 inches, the total engine-wheel base 26 feet and the total of engine and tender 53 feet.

The engines in service are reported to be doing remarkably good work.



NEW YORK CENTRAL'S EXPRESS TEN-WHEELER.

River Steamboats.

The *Water Ways Journal*, of St. Louis, Mo., laments the decline of steamboating, stating that while part of it is brought about by natural causes, such as the lack of water for navigable streams and the formation of sand bars which obstruct navigation, another cause of the decline is the adherence to old-fashioned machinery, such as simple engines and boilers that are wasteful of fuel.

In regard to this, compound engines and other improved machinery will save fuel and reduce one of the heaviest items of the cost of transportation. Then, if it takes less coal for a trip, that leaves more room for paying freight and saves the cost of transporting the fuel, two items of profit.

Sea and lake steamers invariably use compound engines, and they are built for speed—first, last and all the time. A slow boat does not stand much show among its faster competitors.

Prompt dispatch of both freight and passengers is of importance. Nowadays passengers go by the shortest or quickest route. Shippers are also looking for quick trips, as well as low rates. It is not reasonable to suppose that a seven to twelve mile an hour river steamboat will get the business when the competing railroad makes thirty to forty miles an hour, unless the rates are low enough to offset the slow speed.

Rush is the watchword of transportation requirements. If the facilities do not come up to this idea the business will seek faster channels. Railroad men have already learned this fact, and steamboat men will have to study the lesson of progress. That is the important part of every American's business schooling.

In one of the shops of the United States Cast Iron Pipe & Foundry Company, Cincinnati, Ohio, the company have fitted up a room with drawing tables, boards and T-squares as a study room for the use of a number of its employés who are students of The International Correspondence Schools, Scranton, Pa. The class, which numbers about fifty men and includes the general manager, studies on "company time" and is supplied with drawing paper by the firm. All promotions in the shops will hereafter be made from students of this class. The International Correspondence Schools have nearly a hundred courses treating of all branches of mechanical and engineering work. Instruction is carried on wholly by mail, and there are nearly 200,000 students and graduates.

Among the innovations which the old Boston & Providence road introduced in New England was that of lighting its cars with gas. This was done on the old steamboat train in the early sixties, the tanks being charged at Stonington two or three times a week. Gas was also used on the Philadelphia & Reading road in about 1865.

This is the weather when the occasional electric fan in the sleeping car is appreciated.

Making Seamless Cold-Drawn Steel Tubes.

The engineering world has long been familiar with the fact that lead, copper and other comparatively soft substances were used for making seamless tubes. That is, a block of the material was pierced and worked out by a series of manipulations into a tube that had no weld or seam. For a few years past we have become familiar to the expression seamless steel tubes and, later on, to cold-drawn seamless tubes.

Steel is such a refractory material that the idea of drawing it into a tube was rather startling; but when we were informed that steel tubes were drawn cold our wonder grew to an almost irrepressible limit. There was no doubt that the process was achieved, but we were oppressed with curiosity to witness the operation. Several times we made application to go through an establishment where they were making cold-drawn steel tubes, but not till lately was our curiosity gratified.

At the invitation of the Standard Seamless Tube Company, of Pittsburgh, Pa., I proceeded one bright day in June to Ellwood City, Pa., to visit the works of the company and to witness the entire process of making cold-drawn seamless steel tubes. Ellwood is a beautiful little town, resting in the lap of wood-covered hills, with charming surroundings that have no traces of the blackened imprints that generally belong to the headquarters of metallurgical works. The place is about forty miles from Pittsburgh, down the Ohio River valley, through as picturesque a country as one could wish to look upon. It is studded with towns and villages filled with a busy industrial population that appear to have wonderfully proper habits, for the squalor, slovenliness and filth common to mining and manufacturing towns were conspicuous by their absence.

The spot where the shops of the Standard Seamless Tube Company are now in full operation was covered with heavy timber a year ago. A rapid metamorphosis took place, and the wild woods have disappeared to give occupancy to a building 225 x 450 feet, specially designed and equipped for the making of seamless steel tubes. There are a variety of heating and annealing furnaces arranged so that the material to be worked will move towards the machines where the various operations take place with the least possible waste of labor in handling. There are three five-ton overhead traveling electric cranes that traverse the entire shop, and a great variety of machinery for the manipulation of the steel to convert it into tubes. It might be supposed that five-ton cranes for handling tubes was indulging in a big margin of power, but the tubes are handled in lots which make heavy lifting. There are two Corliss engines that supply the power for all the machinery. One is 650 and the other 350 horse-power. That would indicate that the work of drawing steel tubes cold called for considerable power.

After starting at the beginning and following the process of making seamless cold drawn steel tubes to the finish, the impression I received was that it was a wonderfully simple series of operations. The genesis of the work would go back to a great steel making plant, where selected smelted iron and scrap are boiled in an open hearth furnace to produce steel free from objectionable impurities, and possessing the ingredients that combine great ductility, fair tensile strength, high elastic limit and good elongation. Particular care is taken to have the material low in phosphorus and in sulphur.

The material is delivered to the works in long round bars about 4 inches in diameter. These are cut into lengths of about 2 feet or less, according to the size of tubes to be made. The cut-off bar forms the billet which is the beginning of the tube making process. That is put into a furnace and heated to about a cherry red. Then it is put into a machine where it is grasped by a series of rollers and rolled round very rapidly, while a pointed mandrel forces its way through the ingot by a sort of twisting action, not drilling, but squeezing the center into a compressed form, meanwhile piercing a hole about 2 inches in diameter. This process elongates the billet 3 or 4 inches. The hot billet is then taken to another machine, where another mandrel is inserted, and it is rolled to nearly the desired gage in thickness. When the tube emerges from this operation it has more or less oxide on the outside surface. To remove this it is put into a pickling bath, and afterwards thoroughly washed. Then it is put into a tank containing greasy matter to prevent oxidation in the other processes.

From the greasing tank it is taken to an anvil, where one end is hammered to make a hold for the pulling apparatus which draws it through the cold drawing process. Meanwhile it has been carefully annealed to make the material as soft as possible. Then a mandrel holding a die is inserted, and the tube is drawn cold to the proper size, a tremendous pull being necessary. When this operation is completed the tube is reduced to the exact gage required, and the inside shines as bright as the bore of a rifle. It is again carefully annealed to give the necessary softness.

The care necessary in drawing these tubes may be understood from the fact that the government specifications require that they be finished to one-thousandth of an inch within the size called for. The various operations leave the metal very dense and tough, qualities that greatly increase the soundness and durability of a tube. The process of manufacture is so searching that nothing but the best of material will pass through it without developing flaws that would condemn the tubes.

I visited the works at the invitation of Mr. Quincy, of the Q & C Company, Chicago, and was very courteously treated by the president, Mr. Charles E. Pope, and by the vice-president, Mr. J. H. Nicholson, who is manager of the works.

A. S.

A HORSE THAT REQUIRES NO DRIVER.

A Horse That Requires no Driver.

The annexed engraving shows the surroundings of a coal pit in New South Wales and a horse that is particularly worthy of mention, because it has worked there pulling cars for six years without a driver. A man at each end of the route connects and disconnects the cars, and then the horse goes all alone to the end of the trip.

The man who sent us the photograph says, the horse works like a watch and gives no trouble and runs on time.

General Correspondence.

All letters in this department must have name of author attached.

Profitable Philanthropy.

We have been very much interested in the June number of LOCOMOTIVE ENGINEERING on "Profitable Philanthropy." It states in general the idea of the work of this company. However, there is one statement of fact which can hardly be regarded as strictly true. This is at the bottom of the first column, and says that the amount expended per person is about $40 per year. As a matter of fact, during the past year we have averaged about 2,100 or 2,200 people, and the entire expense of the whole work has not been over $30,000 or $35,000. So you see that the amount has been considerably less than $20 per person.

Again thanking you for your interest in our work, we are,

NATIONAL CASH REGISTER COMPANY.
E. L. SHUEY, Advance Department.

Another Remembrance of Old Colony Days.

I once more wish to trespass upon your valuable space to thank Mr. George H. Brown, the South Boston boy in distant Iowa, for his endorsement of my remarks in regard to the Old Colony engines. I also send you a picture recently taken of the "King Philip," and feel that not only friend Brown, but many others, will be glad to renew her acquaintance, if only through the medium of a small likeness. I regret that her number—631—does not show in the photograph, but those who know the old warrior will instantly recognize her familiar outlines. I trust the appeal of our Western friend and the appearance of this picture will influence someone to send in a picture of one of those inside connected engines referred to. I think also a list of the pioneer locomotives of the Old Colony road similar to that which appeared in the last October number of LOCOMOTIVE ENGINEERING applicable to the Boston & Providence motive power way back in 1856 would make very interesting reading. During the seventies the latter road adopted some fine historical names on three of their engines: "John Winthrop," "Roger Williams" and "Paul Revere." The latter was an inside connected engine of very elaborate style and finish, and her first appearance was hailed with enthusiastic delight by the youthful admirers of the locomotives living along the line, recalling, as it did, the opening stanza of Longfellow's stirring poem:

"Listen, my children, and you shall hear
Of the midnight ride of Paul Revere."

Speaking of the English compartment car, I have learned that one of these was wrecked in the Wollaston accident in 1878. If the company had others they were never run again as the great loss of life in that one car created a strong prejudice against English compartment cars.

In conclusion, I would like to add that the old roundhouse in South Boston is doomed to destruction, and that the machine shop has turned out its last new engine, and before many months trains will be speeding over the spot; but Mr. Brown and others exiled from New England's fair shores, will be glad to know that time has not banished from the section of the old Bay State served by the Old Colony Railroad the historic atmosphere for which it has always been so justly famous. The placid, peaceful, quiet old Plymouths, Weymouths, Abingtons, and all the rest, retain their delightful quaintness despite the big railroad changes and the invasion of the clanging trolley cars.

Boston, Mass. W. A. HAZELBOON.

OLD COLONY VETERAN.

Setting up Wedges.

The May number of LOCOMOTIVE ENGINEERING contains an article on setting up of wedges, which the writer claimed was a good way, and he had never seen it in print. Now, as this appears to be an age of looking over the stock and taking your choice, I will offer a way which I adopted soon after I commenced my duties as a locomotive engineer. With the engine under steam, I place the engine with the right crank pin at top forward eighth. Now cut out all brakes except the tender; apply the tender brake, then drive some blocking under enough of your tender wheels in front to secure them in case your brake leaks off. Now place your lever in forward corner, give your engine a little steam, and every driving box will rest solid against the forward wedges. Drive a wedge or block under the back of each driving wheel, open your cylinder cocks, put your lever in the center, commence with your main driving box wedges and put them up as close as possible without sticking, for the thrust on the main rod must be sustained here. Judgment must be used, as new boxes and wedges are usually rough, while old ones are apt to be shouldered or hollowed at wedge. At the back driving box wedges you must allow enough clearance for your engine to adjust itself to the high and low places in the track (consequently more clearance is required in winter than in summer), and here you get more dust and fine coal to fill in around the wedges and absorb the oil. Also in wetting down the deck, water is apt to wash away the oil. A little judgment with the facts in view will save you trouble when on the road. If the engine is a mogul, less clearance will be required at the forward driving boxes than the back ones.

Under this method your engine remains solid and unchanged from start to finish. You are taking no risk with steam in the cylinders. Always remember the company's unwilling to overlook unnecessary risk. Another point—observe the lost motion between engine and tender, and take measurements if necessary.

Pittsfield, Mass. N. B. PARRISH.

Brick Arches.

I would like to say a few words about brick arches. I have had several years' experience as fireman, but never fired an engine equipped with an arch until last fall, and will say that I, for one, am in favor of them. You can keep a much thinner fire in the front end of firebox, the firebrick becomes intensely hot, and this maintains a more even temperature in the firebox. The gases from front end of firebox, instead of rising direct to the flues, are compelled to pass back around the arch, thus lengthening their path to the flues and detaining them for a greater length of time in the firebox, giving them more time to mix with the air and burn. It also prevents fine coal being drawn into the flues unburned, prevents cold air from the furnace door going direct to the flues.

I think one of the principal objections to an arch is that you must keep a cleaner fire and must break up your coal finer, as large lumps cannot be thrown up under the arch when the fire gets dirty. An arch is a protection to flues instead of a hindrance. J. E. POWELL.

La Crosse, Wis.

Management of the Injector.

I have been much interested in the discussions in LOCOMOTIVE ENGINEERING on the most economical ways to work an injector. The article by Mr. Kneass, page 204, May number, is particularly interesting and instructive along the theoretical lines; but he closes rather in doubt as to whether practice will bear these theories.

I have no particular theories to advance, but will give you my observations from actual experience.

When I first commenced firing a locomotive I discovered that by working the injector light the engine steamed easier, and so I commenced to experiment for the best results.

I fired extra for a long time, and was sometimes on an engine for one trip only, so I had a chance to experiment with a good many engines.

My practice was to be sure and have a glass nearly full of water, a full head of steam and a good fire when starting out on the trip. The injectors then were mostly of the non-lifting type; at least, those were the kind I first handled.

I would set my injector to work and throttle it down until water would run out of the overflow. Then with the lazy cock or tank valve would shut off the water until none ran out of the overflow; then shut off the steam and water again until I got it working as fine as possible. I would then note the position of the throttle, so that when we pulled out with our train the injector could be put working the same.

I noted the position of the water in the glass, and if it commenced to lower would open both steam and water valves until the injector would just supply the boiler. Sometimes a whole run could be made without changing the capacity of the injector, and only shutting it off when pulling out of stations. The modern injectors are so constructed that there is quite a range of variation in their capacity; but when one is found that won't work fine enough, it is a good plan to throttle at the valve next the boiler, which will lower the steam pressure at the injector while working.

By working the injector light I have been able to get good results from engines that others called hard steamers. So I would say from what I have observed that it is not a question of putting the water into the boiler at a high or low temperature (Mr. Kneass' figures proved this practically), but does the injector supply it as it is used up, and no faster?

If locomotives were equipped with one injector smaller than the other, so that it would not be necessary to work one so fine, I believe the same results would be obtained. GEO. TRAVIS.

Chicago, Ill.

Keeping Boilers Clean.

On page 209, April 1895, of your journal there is an article headed "Keeping Boilers Clean." This incited me to interest myself in the care of the boiler. A short time after that I was employed as chief engineer of the Portsmouth & Port Norfolk Electric Railroad, Virginia. This gave me an opportunity to see what could be done by keeping the boilers and tubes clean, by keeping the coal damp, by careful firing and just sufficient lubricant. There was no trouble keeping up steam, and very little coal consumed for the amount of work done.

After the summer season I went to Port Tampa, Fla., and got a position as engineer in the electric plant. I found the boilers in a very dirty condition; the fireman had very hard work to keep up steam. After I had the boilers cleaned they had no trouble. I asked myself: "Why does not this rule stand good with the locomotive?" The trouble was how to apply it with the best results. With that article written five years ago in my mind, and by hard work and study I have accomplished it. Electricity is trying hard to take the place of the locomotive.

I have frequently read articles on electricity and noticed how they comment on the short life of the locomotive boiler. There is no reason why the boiler should not be taken proper care of by being washed and filled with water as hot, or very near as hot, as the water that is leaving. That will minimize the contraction and expansion, and as with my device (illustrated in April issue) a standard engine can have her boiler washed, filled and fired and her flues cleaned in one hour and thirty minutes, or less, and a consolidated in two hours or less, there is no reason why it cannot be done frequently.

I have read some very interesting articles in your journal about building fires with old ties, and the danger of spikes getting foul with the grates with disastrous results. With my boiler washing and filling device it is only necessary to get a few handfuls of dirty waste, put a little kerosene on it, throw it on the grates, put on a layer of lumps (soft coal), put on the blower, which can be attached to the steam line of the instrument, and start the fire. In a few minutes give it a couple of bats of the hook, put some more coal on—do not smother it—and you will soon have a fire fit to go out with.

THOS. J. ROSSELL.

New Haven, Conn.

Favors Valve Lead.

I have lately read several articles in LOCOMOTIVE ENGINEERING on the subject of negative lead, or blind engines, and I would like to give you a few cases which have come under my personal observation.

A year or two since, I was running a consolidation, Schenectady, 20 x 24 inches, with long blades. We left the terminal every morning at 4 o'clock for the mines with a train of empties, and after doing the switching, brought back a train of loads.

Four miles from the terminal we reached the top of a hill seven miles long. Leaving the yards and until the train attained a speed of about twenty miles per hour, the engine rode very well. Above that speed it was impossible to ride the engine sitting, and I was compelled to let down the seat and stand up.

I made reports of the matter repeatedly, and finally, growing desperate, I went to the superintendent of motive power. He at once informed me that the "wedges were down." Having but two days previously adjusted these, I challenged him to have them tried, and as a result the machinist reported that he could not move any of them more than 1-16 inch, and *then* he asked me what I thought was the trouble. I told him that the engine was "blind." He said that "lead" was a thing of the past, but consented to have the valves "run over."

When the machinists were changing the eccentrics I prevailed on them to advance them to the thickness of heavy sheet iron. From that time on the engine rode like a coach at all rates of speed, and on the return trip from the mines would climb the hill, which previously had taken from 1 hour and 15 to 35 minutes, in from 50 minutes to 1 hour and 10 minutes, and the lever very seldom went into the corner, where before it never failed to go, and often was compelled to double.

In another instance, out of a number of Pittsburgh mastodons three of them have "lead," the others are set blind. With any one of these three one rarely has to take the slack to start his train (sixty loads), while the others will not start twenty loads without slack, and not one of the "blind" ones can keep within smelling distance of its smoke.

We also have a number of passenger engines set blind. One of these, the poorest of the lot, was given 1-12 inch lead, and on her trial trip attained a speed of 73 miles per hour with a vestibuled train of five coaches, over a piece of track that engine had never been able to make 50 miles on.

Now, while we all think that "testing plants" are good things and that indicators are all right, it is a known fact that "figures can be made to prevaricate," and is it not possible that these things might show up in such a way that they would not "pan out" in actual practice?

We would like to see some of the negative lead advocates present some proofs, and not try to convince us by simply airing their theories, for it takes "smart engines," and not "smart ideas" to pull sixty loads over grades 22 feet to the mile and make time.

In conclusion, I would beg leave to air an *opinion*, as others have done, and it is this:

In the prevailing style of nozzles they rapidly taper from the base to the size of the tip, and then continue to top straight and have the bridge running well up towards the tip, thus taking up unnecessarily the already scant room for expansion and choking the engine at a point where it is utterly impossible to benefit in the least by it, as the only object in choking the exhaust is to cause it to fill the stack and thus create vacuum in order to get steam. This is not to be accomplished by choking far down in the nozzle. This will cause more back pressure and a greater strain on the machinery than lead judiciously given. This will limit the speed to a great extent, cause rough riding at a high rate of speed, and make the engine slow in starting a train. Choking an engine when it can be avoided is something not to be overlooked. The advantages derived from lead greatly overbalance the bad features; but when you choke an engine you add something wholly bad to the bad features of "lead," and the result is a serious state of affairs, and a lot of correspondence for the engineer to tell the transportation department "why."

Danville, Ill. F. DILLON.

POPOCATEPETL. "The Mountain that Smokes." The Famous Snow Mountains. Taken from Village of Cuantlanzingo, 7 Miles from Pueblo, Mexico. Courtesy of N. Barrett. IZTACCIHUATL. "The Lady in White."

Snow Covered Mountains in Mexico.

I send you photograph of the famous snow-covered mountains in Mexico. The photographs were taken from the village of Cuantlanzingo. The peaked mountain on the left is Popocatepetl, that to the right is Iztaccihuatl. Translated, the first means "the mountain that smokes," the latter "the lady in white." N. BARRETT.

Pueblo, Mexico.

Getting Off the Center.

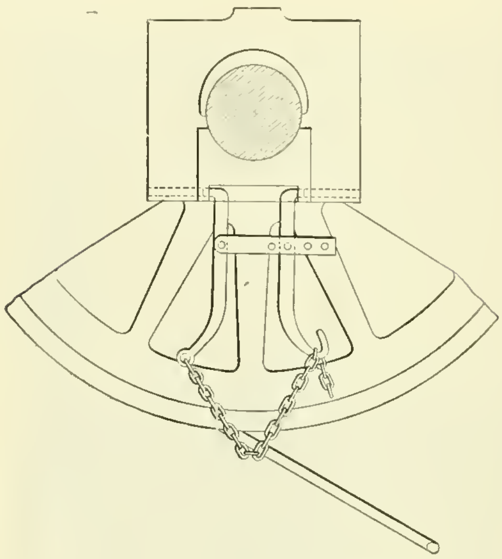
In the June issue of LOCOMOTIVE ENGINEERING Mr. O'Hara presents to the readers a novel way of getting off the center when you are disabled on line or road by engine breaking down on one side. We will give another way of getting off the center when you are on one side, and we would be pleased to hear from the readers as to what they think of it. This plan can only be used when the main rod or pin is not injured in the break-down; but for all other troubles where you must disconnect one side, instead of taking off the main rod, leave it on, take off the valve stem and block the valve with the front steam port open about 1-32 inch. Then should you stop on the center with the good side, the dead side will be on the quarter, and the valve being blocked with front port open, will fill the cylinder with steam, and, no doubt, will move the engine sufficient to get power from the other side. As the steam from the disabled side would be some resistance to the advancing piston, owing to the fact that it could not exhaust, the cylinder cock could be left open while moving along and closed when starting. Leaving the main rod up would save doing a big job, as well as a lot of time, especially on the large engines that are in service to-day, and besides, that piston would get lubricated just as well as the good side. The engine might not steam so well, but when you are disabled, it is not how many cars you can haul, but how quickly you get out of the way.

WALTER C. GARAGHTY.

Chester, Pa.

Device for Pulling down Oil Cellars.

I send you herewith sketch of a simple and effective device for removing oil cellars from driving boxes. It is made of ⅜ x 1½-inch bar iron and a chain of suitable length.



OIL-CELLAR REMOVER.

The downward pressure on the chain by a bar having its fulcrum under the wheel, causes the jaws to grip the cellar firmly and at the same time pulls it from the legs of the box.

J. H. MAYSILLES.

East Deerfield, Mass.

Large Grate Area.

In his great work on railway practice, D. K. Clark gives as his opinion that it is possible to get too large a grate area for coal, and evidently foresaw the era of large areas which appeared later, beginning with Zerah Colburn, and afterwards patented by Wooten—a patent, by the way, which he could not hold.

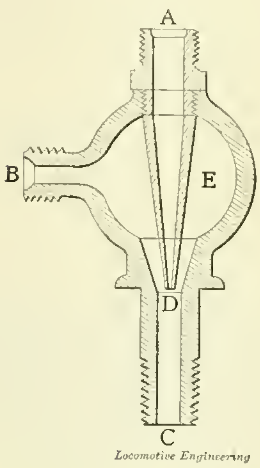
The latest development in this line is the class E1 of the Pennsylvania Railroad. These are 20½ by 26-inch engines, 80-inch wheels and 68 square feet of grate surface. They did good work on the Atlantic City run last year, but had the advantage of picked coal, which, of course, helps any engine.

During the past few months they have been running them on the New York division in the same service as the class L's—which, by the way, are the best all-round engines I know of for hard, fast work. The results have not been altogether favorable to the wide box.

On runs where the L's burn 12,000 pounds of coal to a trip, the E1's burn 16,000, which can hardly be called economy, and the fact that they have blocked one of the grates down to 50 feet with a corresponding improvement in coal consumption, looks as though D. K. Clark might have been right after all. I believe in experimenting; but with the experience of others in this line, it does seem a little strange that after designing such a good engine as the "L," they should go back to the wide firebox and combustion chamber.

R. E. MARKS.

Camden, N. J.



LUBRICATOR ATTACHMENT.

Handling Men.

A person can always tell, when visiting a shop, how the men working there are being handled by their superiors. If the men have a healthy hustle on them, and at the same time look contented, it is a pretty sure indication that they are being handled firmly, but courteously at the same time. It always pays to treat the oldest mechanic, as well as the youngest apprentice, with due consideration of their self-respect.

Some years ago, while foreman of the lathe department of one of the larger roads in the Southwest, I walked through the shop one day with the superintendent of motive power, and while passing a shaper on which an apprentice was planing a shear-blade, and as the boy was running at a rather slow speed I told him in passing to run two speeds faster, which he did. Some hours later the superintendent of motive power met me and asked what I thought of the way in which I had spoken to the boy in the morning. I told him that I thought it all right. He then said: "I do not think so. Had I spoken to that boy I would have said: '*If I were you*, John, *I would try* and run about two speeds faster on that job.' The boy, of course, would have speeded his machine up, and would have done it cheerfully, too, as my remark left the matter practically to his own judgment; while, when you spoke to him he was, of course, in his own opinion running fast enough, and while he obeyed your order, he did it grudgingly and under compulsion. I would always in giving a man orders begin by saying, '*if I were you*, I would do so and so,' and if the man does not take the hint, then it will be time to tell him *I want you* to do so and so! This seems to leave matters more in the men's own personal judgment; makes them feel better, and as a consequence they are more cheerful and more willing to work."

I have since that day always tried to live up to this lesson in handling men, and have found it to give good results.

HUGO SCHAEFER,

Hartford, Conn. M. M.

A Lubricator Attachment.

Seeing at different times articles on the "Hold Up" of the lubricator, I herewith send you a sketch of a device which will effectually overcome this great annoyance, at least it will drain the tallow pipe, and this is the result desired.

Its theory is quite simple; oil pipe connected at *A B* is connected to the steam pipe by drilling into cylinder saddle, causing a constant boiler pressure to pass by the tube *D*, thereby making a variation of pressure—less on the lower side of the tube, which will cause a flow of oil toward *C*, which is the steam chest connection. I have protected the design.

O. A. ALEXANDER.

Rocky Mount, N. C.

A Remarkable Record for Cold-Drawn Steel Tubes.

During a recent visit to Cleveland we had the pleasure of meeting Mr. H. S. White, of the Shelby Steel Tube Company. He rather startled us with an account of some of their tubes on the Pittsburgh, Bessemer & Lake Erie Railroad, but the following letter more than bears him out:

"I am in receipt of your letter of the 29th ult., and in reply would say that about two years ago I placed a number of cold-drawn steel tubes in one of our 19 x 26-inch engines and sent her to the south end of our line, where we have the worst water, and after running her there eighteen months I brought her to the shop and removed all the tubes but the cold-drawn ones, except one, which I removed for examination and afterwards cut it up into safe ends and welded them on to charcoal-iron tubes. This flue was in almost as good condition as on the day it was put in, and in taking it out we had to bend the scarf on front and back end back again to its original shape in order to remove it, and it bent back without a fracture, being very pliable.

"During the time these flues were in

service we did not have to use a flue-expander on them, and we have since placed several sets of these flues in our largest engines. We are getting the best of results from these flues up to date, and it is my opinion that they are the coming tube for locomotives. I have enough confidence in them that I am placing them in our engines as fast as I can.

"There seems to be a prevailing idea that the steel tubes will not make a satisfactory weld with charcoal iron, and I desire to say that we obtain the best results from welding their safe ends on to our charcoal-iron tubes, as they make a very clean, nice weld.

"Yours truly,

"E. B. GILBERT, M. M.

"Greenville, Pa."

Pratte Sander.

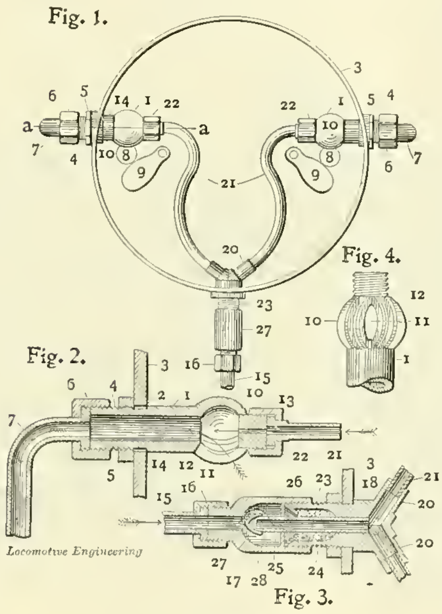
The sanding device here illustrated has just been patented by Mr. C. A. Pratte, copper shop foreman, Moberly, Mo.

Fig. 1 is a view of a locomotive sand-box with the cover removed. Fig. 2 is a vertical section through one of the ejectors taken on the line *a a* of Fig. 1. Fig. 3 is a sectional plan of the air supply pipes and of a sediment or dirt trap. Fig. 4 is a detail plan view showing the under side of one of the ejectors.

The device consists of a pair of sand ejectors, located in apertures formed in the sand-box, opposite each other. The ejectors are formed with a central enlargement, upon the interior of which is an air chamber which is closed on top side and provided in its under side with a slatted or grated portion through which sand enters the ejector. The slats or bars prevent entrance of particles which might clog the entrance to sand pipe. One end of the ejector is provided with an air jet arranged to discharge across the interior of the enlargement and into the combining tube of the ejector. A pipe supplies air in the usual manner, operated by a globe valve, and this pipe is coupled to the outer end of a sediment or dirt trap, the inner end of which is passed through an opening in the rear of the sand-box, and the interior of said box is provided with branches from which lead the air pipes to each ejector. The sediment trap is composed of the body having its inner walls threaded at one end and mounted upon the screw-threaded section, within which is formed a cylindrical recess. A trap tube is connected at its inner end to the air passages of the branches and projects outwardly through the said recess and into the trap chamber of the body, and is located centrally of the recess or chamber. A body of hair, wool or other suitable dirt-collecting material is located within the recess surrounding trap tube, and a flared ring or funnel is interposed between collecting material and trap chamber. The outer end of trap tube is provided with an apexial cap, and a series of small apertures are formed in tube adjacent to base of said cap.

In nearly all the modern mogul or ten-wheel engines of the present day, where the ratio of adhesion is between 4 and 5, sand can be introduced ahead of the main driving wheels, which will give ample sand for both directions. Where it is required to equip engines of other designs to sand in both directions, a duplication of the device will be necessary.

Mr. Pratte, in speaking of the device, says: "I have found that during the operation there will be an accumulation of larger particles of sand and gravel directly beneath the ejectors, and in order to dispose of these it will only be necessary to open the usual discharge valves, allowing the same to be discharged through the apertures. All particles of sediment or dirt which might clog up the air jets are prevented from entering said jets by



PRATTE SANDER.

being first passed through the sediment or dirt trap."

The operation of the globe valve will make it possible to get a very light or a heavy stream of sand on the rail, as desired. The device can be put on any sand-box in one hour.

M. W. BURKE,

Wabash R. R.

Moberly, Mo.

Protecting a Patch Seam in Firebox.

I think Mr. Morse's idea a good one, providing the sheet is offset so as to let your rivets or patch bolts be flush. Then the pipe should be of a good heavy material and a washout plug put in both outside sheets in line with pipe, so it could be thoroughly washed out when the boiler is washed out. I think this much better than castings; in fact, I think it superior to a box patch, as the mud will accumulate in the offset of a box patch, causing it to mud burn. I don't think the tube mentioned would be damaged any by coal, if heavy pipe is used, the same as is generally used in water tubes for supporting brick arches.

I. J. CUNDIFF,

Foreman Boiler Maker, I. C. R. R.

Jackson, Tenn.

Addresses to Technical Students.

We have received from Prof. Smart copies of the twelfth and thirteenth papers in the series of addresses on railway subjects given before the students of the engineering departments of Purdue University. The twelfth paper is on "The Work Ahead," by George B. Leighton, president of the Los Angeles Terminal Railway.

President Leighton spoke of the Bessemer steel rail and the automatic brake as factors in the changes in railroad construction and operation which began about 1870, and followed up by mentioning the later changes to heavier equipment, longer mileage for the machinery, better location and arrangements for terminal yards, the standard code of train rules, the Brown system of discipline, the anxiety among railway managers that all grades of employés should be better schooled and more intelligent than formerly, and the quick response of the men in this direction, so that a technical education such as Purdue gives will be more valuable to railroad men.

The work ahead for the student is a careful study of these problems, for they are not yet all settled.

The thirteenth paper is the address of R. H. Soule, late Western representative of the Baldwin Locomotive Works, on "Notes and Suggestions from Experience in the Motive Power Department of Railways." Mr. Soule's long experience in this department enables him to speak with authority.

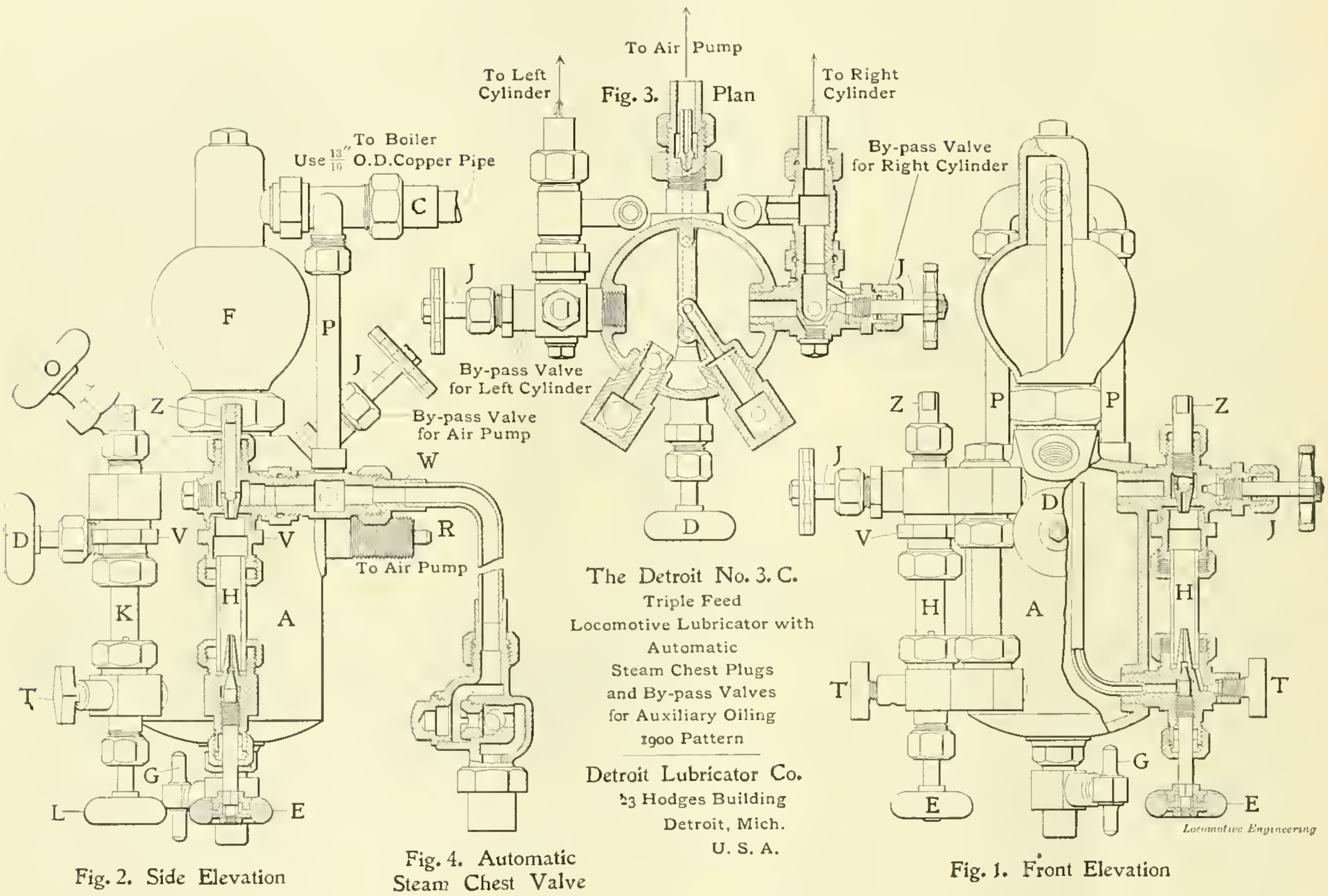
His address takes a wider range. It speaks of the organization of the locomotive department; its needs, and how these wants are supplied; the various technical men, like chemists and mechanical engineers, who can be profitably employed; designing of engines; advantages of compound engines; the heating and lighting of passenger cars; couplers and brake gear on freight cars, and lastly, the maintenance of the equipment, both by the care taken of it while in service, as well as in the matter of general shop repairs. The matter of the students doing both rapid and correct work while taking their university course was touched on in the close of the address.

The Watson-Stillman Company, 204 East Forty-third street, send us a new catalogue of hydraulic pumps. It shows the pumps most frequently called for, and gives data concerning them. They include a telegraphic code for the first time, which will be found a convenience to purchasers. We presume it will be sent on request.

A New Lubricator.

The Detroit Lubricator Company have just put into service a new design of locomotive sight-feed lubricator which has a good many valuable features.

The new cup is of the same general form and size as the No. 3 cup, with the same arrangement of sight-feed glasses and connecting arms for the right and left cylinders, the air pump and the gage glass. In both top and bottom arms of the gage glass connection is a ball check valve, which lies in the bottom of the oil passage when the glass is perfect, but in case the glass breaks, the rush of oil towards



LATEST DETROIT LUBRICATOR.

the glass rolls the ball up against its seat and stops the oil from coming out.

The same kind of a ball check valve is also attached to the bottom of the pipe leading from the condensing chamber to the bottom of the oil tank, which allows the water to pass down but will not allow any to pass upward. This prevents oil "siphoning" out of the oil tank when steam is shut off from boiler connection. A ball check valve is also located at the top of the sight feed glass to shut off the steam in case the glass should break. This replaces the old-style check valve. This ball is located in a case which normally is screwed down on a seat in the top arm, so nothing can pass down into the glass. To blow out the glass or fill it with condensed water, the valve case is screwed up off the seat, and steam and water can then pass from the equalizing tube into the glass.

There is also located in the top arm of the sight feed glass a by-pass valve which can be opened and allow oil to feed direct from the oil tank into the oil pipe; this is to be used in place of the auxiliary oiler in case a glass breaks.

The steam pipe leading to the top of this cup from the boiler has been enlarged from ½ to 13-16 inch, and the equalizing tubes are ⅜ inch inside diameter instead of ⅛ inch, so that a larger supply of steam now goes to the oil pipes.

No chokes are used in this type of cup—the choke being located at the steam chest. A ball check valve is located in the steam chest plug, which gives a variable opening when the engine is working steam or shut off, so the cup will feed steadily.

The Detroit company are also introducing the Barr-Manchester device, which makes a connection from the steam pipe in the smoke arch to the steam chest plug.

Railroad Commissioners' Convention.

The Twelfth Annual Convention of State and Federal Railroad Commissioners was held at Milwaukee, Wis., May 28th and 29th. About one hundred commissioners and other persons directly interested were present, and twenty States were represented. The presiding officer was Mr. C. J. Lindley, chairman of the Railroad Commission of Illinois. In opening the meeting, Mr. Lindley delivered an address, in which he referred to the work done by State Commissions for the public, and to the fact that citizens generally do not appreciate the good work which their commissioners do. Commissions are not established simply to fight the railroads; they are to enforce laws and to suggest desirable new laws. To enforce laws and secure public approval a commission must be impartial. Mr. Lindley made a plea for legislation to enable the State Commissions, as well as the Federal Commission, to promptly enforce their orders.

The following officers were elected: President, Cicero J. Lindley, of Illinois; first vice-president, W. D. Evans, of South Carolina; second vice-president, T. J. Hennessy, of Missouri; secretary, E. A. Moseley, Washington, D. C. The next convention will be held in San Francisco, and the members declared in favor of Charleston for 1902.

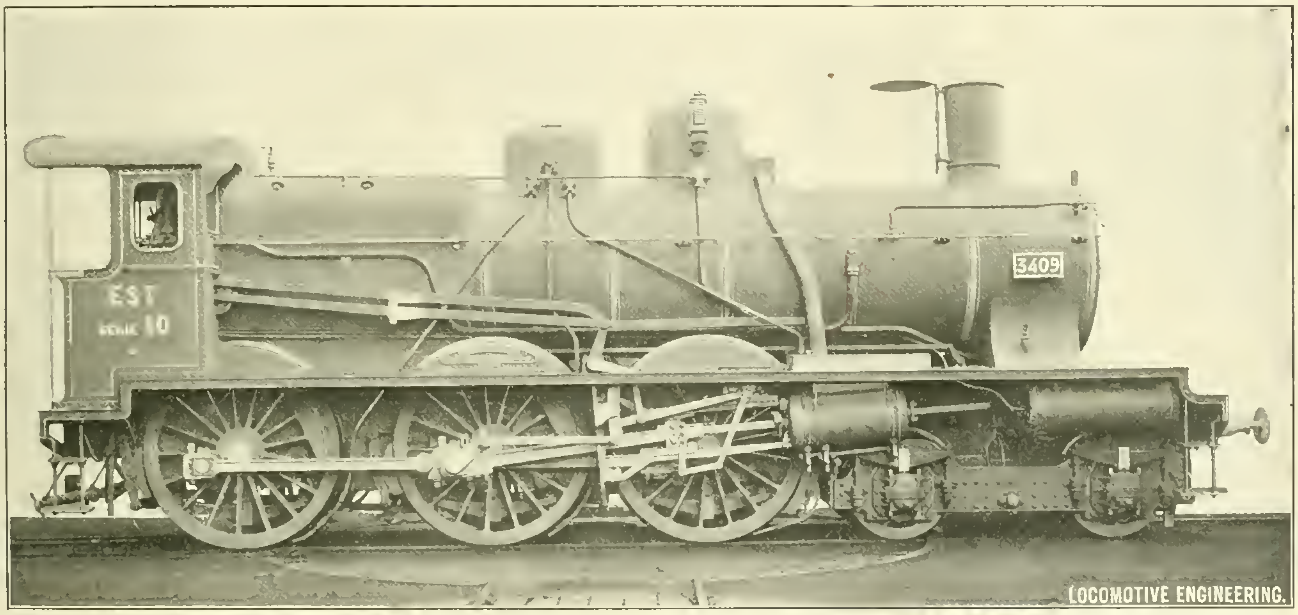
The Chicago Pneumatic Tool Company send us a copy of their special Paris edition of their catalogue. This contains sixty-four pages, is fully illustrated, and gives the description of every tool in English, French and German.

French Locomotive.

The locomotive herewith illustrated is one of a type recently designed by M. Salomon, the chief mechanical engineer of the Eastern Railway of France. The engine is compound, having four cylinders, two in the outside and two inside.

The drivers are about 69 inches diameter. The low-pressure cylinders, placed inside the frames, are about 22 inches diameter by 25 inches stroke, and the high-pressure cylinders outside are about 14 inches diameter by 25 inches stroke. The boiler is about 58 inches diameter and 161 inches long. There are 130 Serve tubes, 2¾ inches diameter. The firebox, as will be noticed, is of the Belpaire type, with a grate area of 27 square feet.

The working pressure is about 213 pounds per square inch. The valve motion is of the Walschaert type for both high and low-pressure cylinders, that style of motion being in great favor with French engineers.



EASTERN RAILWAY OF FRANCE FOUR-CYLINDER COMPOUND EXPRESS ENGINE.

Double Headers.

The question of increased danger to engine and train men with a double header as compared with a train drawn by one engine was brought to the attention of the Texas Railroad Commission lately. The matter was first before the Legislature, and the passage of a law prohibiting the practice asked for by the employés. It was then referred to the Railroad Commission, and that body, after hearing the arguments from the employés on one side and the companies on the other, decided that the evidence did not show any increase of danger with a double header. They decided also that there was a decided economy in the transportation expenses, and that transportation facilities could be very much improved by the use of two engines on one train in that State.

On the other hand, on the Connellsville and Cumberland divisions of the Baltimore & Ohio Railway the double-header system has been abolished by an order from the company. In order to enable one engine to handle the train, it has been limited to thirty cars.

Smoke Defacement of Cities.

Numerous cities are making life miserable for railway officials on account of the smoke from their engines, which indicates a wholesome respect for the saying that "Cleanliness is next to godliness."

The inconsistent feature usually is that factory chimneys belch forth smoke without much protest when there is far less excuse for it. A stationary plant has a far more steady demand on its boilers than a locomotive, and should make less smoke in proportion. That this is not the case can be seen in almost any large city, particularly in Pittsburgh, Cleveland, Cincinnati or Chicago. A casual glance at some of the huge chimneys here will show that the only reason they are not making more smoke is that the chimney isn't larger, for they are certainly doing their level best in this direction.

In a recent visit to Cleveland, we noticed that the smoking habit held sway with a large majority of chimneys, but there was an occasional shining example of how this can be avoided, which should prove a good object lesson to the despoilers of the beauty of that city. There is no better example of "it might have been" than the Soldiers' and Sailors' Monument in that city. Beautiful in design and workmanship, it would be a credit to any city, if one could only see what it was originally. But the lines of beauty and the expressions of the faces are all lost in its sombre mantel of soot.

Railroads are not blameless in this matter, but we trust the newly appointed Commission will deal with the offenders in consideration of the ease with which the nuisance can be abated; and as Prof. C. H. Benjamin will probably be at the head of the Commission, we expect to see justice done to all concerned.

Curious Railway Practices in India.

Railroad business seems to be managed in a curious way in India. Items in a recent number of the *Railway Times* say:

A night station master allowed a local train in, in preference to mail. Was he fined? Oh, No! The acting day station master was, to the tune of Rs. 5, though he was in bed at the time.

A guard's equipment was found, on examination by "A. D. T. S.," to be short of fog signals. Station master and guard fined Rs. 5 each; the former's was subsequently canceled. Had this zealous A. D. T. S. made inquiries before resorting to punishment, he would have learned that the stores issued but six instead of twelve signals, and there are guards, are there not? Who can assert that they not only received only six, but had this number for months. Why? Because there were none in stock?

It won't be surprising if the guard of the train I traveled by is fined for insufficient lamps for the carriages; some were in total darkness. I inquired if it would go *without lamps,* and was told "yes." Deficiency of stock, like the fog signals; yet the guard was fined for having half his equipment. Verily, the ways of railway officers are past finding out.

A few flower-beds around a station add much to its appearance.

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Peculiarities of Heat.

The manifestations of heat whose sensations are so familiar to every living creature represent some of the most important phenomena in the universe. Heat not only keeps our bodies comfortable, cooks our meals and creates steam to operate our factories and move our trains—it performs nearly all the functions that make the world habitable. In the form of transparent vapor, heat raises the water that forms clouds and saturates the atmosphere so that rain falls to fertilize the earth. The rain falls at high levels and makes our running brooks and rivers that drive mill wheels and carry burdens of merchandise on their buoyant depth. Heat moves the air and creates the currents of wind that drive our ships and force the purifying gases of which air is composed into every place where lurking disease germs linger awaiting victims. It also performs numerous other operations that are of the highest importance in the economy of nature.

It was natural as soon as men became sufficiently developed mentally to speculate upon the causes of natural phenomena, that they should try to find out what heat was, what it consisted of and how it came into existence. The wise men of the East who helped to create the learning and to accumulate the knowledge for which Egypt, Greece and Rome were once famous, found a favorite subject of speculation in the nature of heat. But they merely speculated. The philosophers of the last two centuries have mixed experiment with speculation and reasoning and the use of weighing apparatus. By these means discoveries have been made that establish theories of the nature of heat that unbelievers cannot controvert.

The ancient theory about the constitution of heat made out that it was a kind of matter, a subtile fluid whose entrance into a body created a feeling of warmth and whose escape left the sensation of cold. This heat matter was called caloric, and was supposed to be stored within the interstices of substances, some kinds holding more than others, according to their various capacities. It was supposed to have an attraction for the particles of other matter, combining with them, while its own particles were self-repulsive. That material theory of heat was firmly believed in for many centuries by the best thinkers in the world, although now and again some philosopher would throw doubts upon it; but no proof was ever produced that other theories rested upon a better foundation. Within certain limits the material theory was highly natural, and its simplicity made it comprehensible to minds of meagre imagination and incapable of profound reasoning.

The fact that a piece of iron is perceptibly heated when held on an anvil and struck by a hammer was long common knowledge, and nearly every traveler was familiar with axles getting hot when they were not properly lubricated; but these things made little impression upon the scientific world until the subject was taken up systematically towards the end of the eighteenth century by Count Rumford, an American scientist. He found that the heat generated in the boring of a cannon was contrary to the materialistic theory. There was new heat manifestly generated by the cutting tools. Continuing his researches by many ingenious appliances and methods, he proved that heat could be created by friction or impact, and that instead of being a material fluid, it was a mode of motion.

Since that time many new discoveries have been made confirming the conclusions arrived at by Rumford. The dynamical or mechanical theory of heat is now generally accepted, and there is every reason for believing that heat and mechanical force are identical and convertible one into the other.

In the course of a long series of extraordinarily accurate experiments, Dr. J. P. Joule, of Manchester, England, showed that 772 pounds falling through the space of 1 foot produces sufficient heat to raise 1 pound of water 1 degree Fahr. at its greatest density. It has also been proved that 1 pound of water falling through 1 degree of temperature gives out sufficient heat to raise 772 pounds 1 foot high. This is known as the mechanical equivalent of heat, and it forms the standard unit of heat measurement. It is frequently spoken of as the thermal or heat unit.

Later experiments with highly perfected instruments for measurements of heat indicate that Joule was a little in error, and that 778 is the correct mechanical equivalent of heat. Joule, however, deserves very great credit for the discoveries he made.

Different substances require very different quantities of heat to effect in them the same rise of temperature. The capacity of a body for holding heat is called its "specific heat," and is understood to be the number of units necessary to raise 1 pound of the substance 1 degree Fahr. in temperature. The capacity for heat of all substances is reckoned in comparison with water, which is set down as unity or 1. Compared with that they are:

Cast iron	.13
Wrought iron	.113
Zinc	.0955
Copper	.095
Silver	.097
Tin	.057
Mercury	.033
Gold	.032
Lead	.0314

To avoid puzzling calculations, it may be said that the quantity of heat which will raise 1 pound of water 13 degrees will raise 1 pound of cast iron 100 degrees. In a like manner the heat which will raise 1 pound of tin 1,000 degrees, will raise 1 pound of water 57 degrees.

In other words, the specific heat of water, or 1, divided by the figures given will show the number of degrees which any quantity of heat will raise 1 pound of that metal for every 1 degree that the same heat will raise the temperature of 1 pound of water. The other substances will be raised according to their ascertained capacity for heat in proportion to water. The quantity of heat required to raise 1 pound of water 1 degree Fahr. is known as the thermal unit, the water being at its greatest density, or about 39 degrees Fahr. When the temperature of the water is higher it requires a little more heat to raise it 1 degree.

There is another conspicuous phenomenon of heat which is known as latent heat. When by heat a solid substance is converted into liquid form or a liquid form turned into a gas, a great amount of heat is expended in the work which is not sensible to the thermometer. This heat which thus disappears is called latent heat, a rather misleading term, adhered to for want of a better one. For instance, take

1 pound of ice and apply heat to melt it. To convert it into water sufficient heat will be expended to raise 1 pound of water about 140 degrees Fahr., but the temperature will remain at 32 degrees Fahr. Take the same pound of water at the freezing point and apply heat to convert it into steam. At first 180 heat units will be expended in raising the water to the boiling point, 212 degrees Fahr. When the heat is continued about 966 more heat units will be expended in converting the water into steam, or 5.37 times the heat required to raise the water from the freezing to the boiling point, yet at atmospheric pressure the thermometer will show only a temperature of 212 degrees Fahr.

In both cases the heat used up without affecting the thermometer was said to become latent. This heat has been expended in two ways—first, in overcoming the internal molecular resistances of the water in changing its condition from water to steam; second, in overcoming the external resistance of the atmosphere with its pressure of 14.7 pounds per square inch.

When steam is condensed for heating or other purposes, the amount of heat expended in overcoming the internal molecular resistance is returned; that expended in the mechanical work of pushing against the atmosphere is lost. A total of 1,146 heat units has been expended in converting the pound of water from freezing point into steam of atmospheric pressure, in which it occupies a volume of 1,644 times that originally held by the water. The heat has been distributed:

	Units
(1) In raising the water from freezing to boiling	180
(2) In overcoming internal resistance	893.7
(3) In overcoming pressure of atmosphere	72.3
Total	1,146

The tendency of heat is to diffuse or spread itself among neighboring bodies until all of them have reached the same temperature. This spread of heat is effected by three different processes, known as radiation, conduction and convection. Radiation is the transmission of heat through rays, in the way that heat reaches the earth from the sun. Bodies of all temperatures radiate heat. The intensity of radiant heat, however, varies inversely as the square of the distance from its source and the obliquity of the rays to the radiating surface. Nearly all dull and dark substances are good radiators of heat, but bright and polished surfaces are generally bad radiators.

By conduction heat is communicated from particle to particle of any substance, some substances possessing a much greater capacity for the transmission of heat than others. Silver is the best known conductor of heat, and as a unit of measurement is taken as 1,000. Compared with silver, gold is 981, copper is 845; zinc, 641; tin, 422; steel, 397; wrought iron, 436. Bodies in which heat is readily conducted are called good conductors; while those in which heat passes slowly are called bad conductors. The metals are the best conductors of heat. Resinous substances, glass, wood, gases and liquids are poor conductors of heat; so are all organic substances, such as wool, cotton, hair and fibrous material of all kinds. A few mineral substances, such as asbestos, magnesia and others, are bad conductors of heat.

In the arts the good conducting substances are employed when it is desirable to conduct heat or electricity with the least possible resistance. Bad conducting material is employed to prevent waste of heat by radiation, boiler and steam pipe covering being generally made from the best non-conducting material.

The heat of a furnace is conveyed to the water inside of the boiler by conduction through the furnace sheets and tubes. In some countries furnace sheets are made of copper, because that metal is greatly superior to steel as a heat conductor. Heat from the fire in a furnace is conducted to the sheets by radiation. A bright white fire does not radiate the heat so freely as one that has a dull flame. This is how a mixture of bituminous coal increases the steaming properties of anthracite coal.

All liquids are such poor conductors of heat that heat applied to the upper parts of a vessel containing water will not be diffused through the whole body. A familiar illustration of this is to take a glass test tube filled with water and apply heat to the top. The upper part of the water will boil, while the bottom remains cold. Another good example of the non-conducting peculiarity of water is that the lower part of the firebox of a locomotive boiler is frequently cold when a full pressure of steam is upon the boiler.

When the water is agitated, the heated particles will mix through the mass and cause some circulation, but if the heat is applied to the lower part of the vessel, the heated particles becoming expanded are made specifically lighter than the mass, and will rise to the surface to be replaced by colder water from above. This induces a circulation that brings the whole body of water in turn in contact with the heating medium. This is known as heating by "convection."

These observations about heat phenomena are of an elementary character, but, like elementary information on many other subjects, they are not so universally understood that repetition will read like a story often told.

The Heavy Locomotive.

The increased weight of engines, especially those for heavy freight work, have caused many a head to wag in ominous silence with unmistakable signs of condemnation. The present monsters are too heavy, they say, and the economical limit has been passed.

We do not agree with them, and time will prove their error just as it did in the case of the Massachusetts legislator who opposed the building of what is now the Boston & Albany road on the ground that it was not necessary. He also offered to wheel all the freight presented for transportation during his lifetime in a wheelbarrow.

The big engines have come to stay, and the end is not yet. Larger engines are being and will be built as long as it is likely to increase economy of hauling freight on trunk lines. The size is likely to be limited by gage of track, clearance width and height of bridges or tunnels.

Even now the builders of compounds have about reached the limit of clearance with 35-inch low-pressure cylinders, and the only remaining room for increase is in adding cylinders. That this is being considered by all the large builders is an open secret, and we may expect to see tandem compounds much more frequently in the comparatively near future than in the past. This is not an abandonment of a type, but a growth to secure greater power. The next limit to be reached would seem to be the boiler, and this in most cases is likely to be the deciding factor.

The construction of these four-cylinder tandem engines, of course, remains to be seen, and will probably vary with each builder.

Possibly the simplest way is to use the low-pressure cylinder for starting, giving it full boiler pressure; but this necessitates making the low-pressure cylinder and piston much heavier than is needed for regular work. Of course, the steam could be wiredrawn to reduce pressure, but the easiest way to do this and be sure that you are getting the desired pressure in the low is to use a reducing valve of the differential piston type. These are not expensive to make, can be depended on to act as desired, saving the low-pressure cylinder from unnecessary pressure.

The starting power can be made to vary according to weight of engine. By closing the reducing valve entirely the high-pressure cylinders alone are available. But by proportioning the areas of the differential pistons any desired pressure can be used in the large cylinder up to the limit of slipping the wheels. These are but suggestions of how it might be done, and the working out of the problem will be interesting to all railroad men.

A rather ingenious device for indicating loads of cars has been patented by Mr. C. T. Driggs, of Erie, Pa. It seems to be a sort of spring balance with indicator dial, and is placed under the truck bolster. Whether it will work out in practice remains to be seen, but the idea is both simple and novel.

Making Road Tests of Locomotives.

There was a very edifying discussion at a recent meeting of the Western Railway Club on a paper presented by Professor Breckenridge, professor of mechanical engineering of the University of Illinois, on "Locomotive Road Tests—How Should They be Made?" Professor Breckenridge, like most other school men, when dealing with engineering problems, wants the work to be done with the greatest possible elaboration. He submitted a method of making road tests of locomotives which called for reports on eighty-two points besides the filling up of six log blanks. We wish to be fair towards the learned men who are giving time and thought to scientific investigation of the working of locomotives, but we are compelled to admit that the tremendous elaboration of detail which they urge as necessary in making locomotive tests renders the work ridiculous and discourages the ordinary master mechanic from trying to find out by means of the steam-engine indicator what is the condition of his various locomotives. Several years ago a most elaborate report was made to the Railway Master Mechanics' Association on the testing of locomotives, which if carried out would require an army of experts and would bring out a volume of information that no one would derive the least benefit from, and which would throw no useful light upon the working of the engine. We do not believe that any person ever attempted to follow the elaborate tests recommended in that report, but we think that it has stood as a barrier in the way of making the few simple tests necessary to find out whether or not an engine is using the steam properly in the cylinders. Professor Breckenridge evidently took the report to the Mater Mechanics' Association as a basis and added as many others as ingenuity and experience could suggest. His well-meant efforts are calculated to do much more harm than good.

Nearly all railroad companies ought to make the steam-engine indicator a useful tool in daily use to find out defects of locomotives; but when the officials read statements from learned men telling that tests cannot be properly made without the presence and aid of a host of scientists, they conclude to endure the evils they know the weight of rather than to shoulder unknown ones that may crush out their official existence.

On nearly all steamboats the steam-engine indicator is applied to the engines once a watch, or at least once a day. Two men at most are required to do the work of taking the indicator diagrams. Very little data are taken beyond working out the horse-power developed in the various cylinders and noting any distortion due to defects, which would be remedied at the end of the voyage. The engineers who manage these engines are practical men who do not care a cent for finding out "highfalutin" data. They merely want to record how the engines work and to put on their log indications of deterioration. To them the indications of a leaky valve or piston are important; they care nothing about how far the temperature of the steam may be above the freezing point. The same plan ought to be followed by locomotives, and it ought to be carried out daily and systematically. A traveling engineer and an assistant ought to be all the force necessary to do the work. If they recorded the boiler pressure and the revolutions per minute, the indicator diagrams would tell all that was worth knowing. The presence of leaky valves, leaky pistons, too much back pressure or excessive compression would all be indicated by the diagram, and the remedies could be applied when the opportunity came. If that simple practice were generally followed, it would greatly profit railroad companies, for it would point out the leading defects of engines that were running down, and the practical men in charge would apply the remedies that would save many tons of coal.

We have the very kindliest feeling towards the good intentions of Professor Breckenridge when he undertook to instruct railroad companies on the proper way to carry out road tests of locomotives. If he had gone through a little experience as a roundhouse foreman or as a traveling engineer, the men who are responsible for putting locomotives upon their very best behavior, we are certain that he would have cut down the items calling for information about 80 per cent. We find among the eighty-two reporting items a variety of questions asking for facts of which the following are fair specimens: "Cut-off pressure above zero; release pressure above zero; compression pressure above zero; lowest back pressure above or below atmosphere, etc." If people start out with the indicator to try to discover how the steam does its work on the pistons, during the various parts of the driving-wheel revolutions, and imagine that there is intimate connection between the efficiency of the steam in making the driving wheels turn round and that of the release pressure above zero, they will have considerable work in calculating the connection between the two. Other items of the eighty-two requirements which might be regarded as more practical than the questions quoted, are the questions: "Weight of ashes and refuse in ash pan; weight of cinders from smoke-box, etc." Particulars of that character are of importance with stationary engines, where it is desirable to find out the quantity of ash in the coal, but with a locomotive where half the ashes that fall through the grates drop to the track, and the quantity of ashes left in the smoke-box is dependent upon the arrangement of the position of the diaphragm and netting, collecting the information is absurd waste of labor.

The indicator applied to locomotives in the sensible manner it is applied to marine engines would make its use popular. Requiring that its application should involve a mass of data of no practical utility is calculated to make the instrument unpopular, and has done so for years.

Valve Setting.

Some time ago a paper was read at one of the railroad clubs in which strong arguments were presented against the practice of setting the valves of locomotives with lead in full gear. Locomotive men have a decided tendency to follow a fashion as sheep follow a leader, and with as little exercise of judgment or common sense. The asseveration went forth that setting valves with lead in full gear was a mistake and that setting them blind would produce better results in the distribution of steam, and it suddenly became the fashion to follow this practice. Several of our correspondents, practical men who are responsible for getting their trains over the road on time, have taken up this subject, and the consensus of opinion expressed is that engines set with their valves blind or with no lead are slow in starting and use up more fuel in doing their work than engines whose valves are set with a judicious amount of lead. Locomotive engineers as a rule demand more lead than it is often wise to give; but the ordinary run of intelligent men of this class may be depended upon to give advice that is worth following. When an engine that a certain man has been running goes through the back shop and comes out deficient in starting power and wasteful of fuel, the opinion of the man who has been accustomed to running her is well worthy of consideration and attentive respect.

The assertion and supporting reasoning that certain locomotives suffered in the point of cut-off from having too much lead opening, was perfectly correct, but it applied only to engines whose design of valve motion made exaggerated valve opening when working with a short cut-off. This is a very common defect, and all kinds of ingenious adjustments have been resorted to in order to overcome the defects of the original design, and the mistake commonly made has been to apply the remedies to engines that did not require them.

Take an ordinary engine of 24 inches stroke. When cutting off at quarter stroke this engine, if the valve motion is properly designed, will give a valve lead opening of from 1/4 to 5-16 inch, which is by no means excessive. If a man who has got the blind fad in his bonnet is permitted to have his will on this engine, he will change the motion so that the valve has no more than 3-16 lead at the point where most of the hard work and fast running are done. This is not sufficient and the reverse lever has to be advanced a notch, thereby using up steam which would be saved if the proper lead opening was given.

In another part of this paper we publish some indicator diagrams taken from an engine running on the Plant System. A study of these diagrams will present interesting information for those who are inclined to reduce the initial lead. The diagrams taken before adjustment show that the full admission of steam did not get into the cylinders till the point of cut-off was nearly reached. The result was loss of power and waste of steam. We are persuaded that a great many more engines having well-designed valve motion are working under similar conditions. At the best, setting a valve blind to overcome a defect of valve is a species of mistake made to correct a mistake, a species of engineering that ought to be avoided if possible. When this kind of distortion becomes a fad and a fashion its results are certain to prove disastrous.

The Potentialities of the Electric Furnace.

The various methods that have been developed of late years for concentrating immense heat energy on the melting, the combining and mixing of refractory substances have brought forth wonderful results in various industries; but none so remarkable as the electrical furnaces used in the manufacture of carborundum at Niagara Falls. Here, says S. B. Rand, a writer in McClure's Magazine, 1,000 horse-power from the mighty falls is conveyed as electricity over a copper wire, changed into heat and light between the tips of carbon electrodes and generates heat of about 7,000 degrees Fahr., a heat so intense that it burns and vaporizes every known substance. Under heat of this intensity steel and nickel and platinum, the most refractory of metals, burn like so much beeswax; the best firebrick known to furnace makers is consumed by it like lumps of resin, leaving no trace behind.

The man who designed these furnaces and manages them is Mr. E. G. Acheson, a graduate of Edison's laboratory. They were designed for the manufacture of material that requires intense heat for fusion. Those interested believed that they could make diamonds, or at least some intensely hard substance to be employed for abrasive purposes in place of emery. Mr. Acheson had an idea that an artificial combination of carbon and aluminum could be effected in the heat to be developed. He produced an intensely hard substance which would scratch the ruby, and he called it carborundum, in the belief that it was carbon and aluminum; but chemistry afterwards proved that it was a composite of carbon and silica, a new substance. Its chemical constituents did not, however, matter, for the important fact was manifest that a highly valuable article of merchandise had been created, and they proceeded to make it. Ten furnaces are now in use producing carborundum, which has been very successful as an abrasive, and is gaining in popularity.

The furnaces have a curious appearance to those who have preconceived notions of how a furnace should look. They have no chimneys nor any of the usual attachments of furnaces, but they get decidedly hot. Each furnace is about 5½ feet high, 6 feet wide and 16 feet long. Outside of the material to be treated, the principal thing in the furnace is a cylinder of pulverized coke, which produces the heat through the resistance it offers to the passage of a strong current of electricity. The furnace is about half filled with a mixture of pure white sand, coke, sawdust and salt; then the cone, 21 inches in diameter and 16 feet long, is carefully put in place. This is then connected at each end with an immense carbon terminal, consisting of twenty-five rods of carbon, each 4 inches square and nearly 3 feet long. These terminals carry the current into the cone from huge insulated copper bars.

Then the current is turned on and the electrical energy represented by 1,000 horse-power is permitted to do its creating work for 36 hours. A volume of heat is expended in that time that would be sufficient to bring 350 tons of iron to a red heat. At the end of that time the furnace is permitted to cool, and as soon as possible the carborundum is removed. It is found in beautiful purple and blue crystals that are nearly as hard as the diamond and are more indestructible, being less inflammable and wholly indissoluble in the strongest acids.

There is no conceiving what the possibilities of this electrical furnace may be. They are preparing to make graphite with it from the refuse of coke furnaces. It looks highly probable that before many years pass diamonds may be made and sold by the pound at a price no higher than now charged for carborundum.

Now about heat comparisons: A firebox, when the engine is worked at its hardest and the fire is glowing white, has a temperature of from 2,000 to 2,500 degrees Fahr.; in the best modern blast furnaces, in which the coal is supplied with the best artificial draft to make it burn as fiercely as possible, the heat may reach 3,000 degrees Fahr. In other special forms of furnaces the heat has probably been raised under favorable circumstances to 3,500 degrees Fahr., yet that is not more than half the intensity of heat developed regularly in the electrical furnace.

Too Much Heating Surface.

American engineers, as a rule, have been very sparing with the heating surface of boilers for the work they were designed to do, and all over the country there are boilers that are run very expensively because the heating surface is too much curtailed. A feeling has been growing lately in engineering circles that this curtailing is a source of waste, and a sentiment has grown up that a boiler cannot have too much heating surface. This is subject to modifications of common sense.

We notice that a great many enormous locomotives are used for light trains, the principal desire being to have an engine with a boiler having a great margin of heating surface. In many cases where this is done, the work done in moving the engine is about as great as the work done in moving the train. It is a very good plan for our master mechanics to remember that an engine has its economical load, and in general this load is what the engine will haul comfortably while cutting off from 25 to 33 per cent. of the stroke.

In a lecture delivered by Dr. Coleman Sellers before the Franklin Institute a short time ago, he mentioned a curious incident in the early engineering of the country, where the boilers had to be made small to provide steam economically for the engines. He said that when the first engines and boilers for the waterworks of the city of Philadelphia were installed many years ago, it was found upon test that the boilers were insufficient for their purpose. Oliver Evans, the celebrated engineer, who ought to be credited with being the father of the high-pressure steam engine, designed the engines and specified the size of grate and furnace to be used, and also the length of the boilers, which were of the plain cylinder type; but the wise men of the city government thought they could do better by making boilers much longer than he had suggested, and they were so constructed. Upon their failure to do the work, Evans was sent for in haste to correct the difficulty. His message to those in charge, enforced by his presence afterwards, was that they must cut off 10 feet from the length of each boiler. This seemed a strange proceeding, but he soon explained to them that the extra length which they had added to his prescribed dimensions was acting as condenser to reconvert steam into water, inasmuch as the heat of the furnace could not extend the whole length of the boilers as they had been built. Upon cutting the boilers down to their proper size, so that the heat could extend over the whole fire surface, they proved sufficient for their work, and continued to operate as long as this primitive water plant was in existence.

Now that variable nozzles are being discussed, it is interesting to note that as early as December, 1854, Matthew Baldwin filed a caveat for one. This opened automatically by the steam pressure. When pressure was high the nozzle was opened, and if it decreased, the size of the nozzle was also decreased, so as to increase draft on fire. The device was never put in service, however.

Velocity of Wind.

In his work on "Atmospheric Resistance" Mr. F. U. Adams gives a table prepared for the United States Government on the average velocity of wind. It represents the wind velocity for several years, and gives the average as 9.5 miles per hour. There is good reason for believing that the reports of wind blowing at 40 or 50 miles an hour are exaggerated. We have been on engines during very fierce rear wind storms, but we never saw the smoke from the smokestack driven forward. The statement is made that no gale in this latitude moves with the velocity of a fast passenger train. It therefore follows that the pressure on passenger cars, due to the displacement of the air, is greater than that exerted by the most severe gale.

BOOK NOTICES.

"Practical Treatise on Gearing—Sixth Edition." Brown & Sharpe Manufacturing Company, Providence, R. I. Price, $1.

A new edition of this book is always welcome, as we are then sure to have the latest methods in use. There is considerable new matter in this, and a whole chapter has been added. This tells how to cut spiral gears on a universal milling machine, and is just the information a good many machinists have been looking for.

"Our New Prosperity." By Ray Stanwood Baker. Published by Doubleday & McClure, New York. Price, $1.25.

This is a well-written book and has rather striking illustrations of the comparisons between countries. It tells of the causes of depression, of the coming of better times and the effect on different lines of industry. The expansion of foreign commerce is also treated, while coal, coke, wool and lumber come in for their share of attention. Those interested in business affairs will want to read it.

"The Trackman's Helper." By J. Kindelan. Published by the *Roadmaster and Foreman*, Chicago, Ill. Price, $1.

Although this was originally written by Mr. Kindelan, it has been revised by three well-known road men and brought up to date—in fact a little ahead of time, as it is called the twentieth century edition. It now has 334 pages and contains 23 chapters on the various features of track work. Judging from the numerous calls in our book department, this is a popular book, and the new edition is of course an improvement on the old.

"Crafts' Tables of Plate and Rivet Values." By Thos. H. Crafts, 16 Kelton street, Cleveland, Ohio. Price, $1.

This is a compilation in very compact form of the values of plates and rivets of various dimensions, and is useful either in designing or determining the strength of joints already made. It is intended for the use of boiler designers, makers, inspectors and engineers, and is well worth the price. The labor of calculating such a table is enormous, and deserves credit. It is got up in a very substantial manner and is handy for use at any time or place.

"New Hydraulics," By M. E. Sullivan, H. E. Published by Mining Reporter Press. Price, $3.

This seems to be a very thorough treatise on hydraulics, starting with the author's formula for the loss of head or pressure for various sized pipes. The generally used formulas are claimed to have been computed for medium sized pipes, and are erroneous for both larger and smaller diameters. Its 283 pages are filled with data that should be useful to any hydraulic engineer or, in fact, anyone having even occasional reference to hydraulics.

"The Nerve of Foley, and Other Railroad Stories." By Frank H. Spearman. Published by Harper Brothers, New York. Price, $1.50.

Railroad stories seem to be quite the thing just at present, and we have all sorts and varieties. This volume is about an average, and is certainly thrilling, although some of it is outside the realms of possibility. This contains "The Million Dollar Freight Train," where the wiper wins glory by running an engine during a strike, and was mentioned in a recent issue in not very complimentary terms. We do not say the stories are not interesting, but they are certainly not written by a man familiar with railroading.

"The Steam Engine Indicator." By Cecil H. Peabody. Published by John Wiley & Sons, New York. Price, $1.50.

There are so many books on the indicator that we are apt to look at new ones as almost unnecessary. This is not always the case, however, and in this instance we know that entire confidence can be placed in the author. One paragraph strikes us as being particularly serviceable to those new in the use of the indicator. It says: "Too much emphasis cannot be given to the fact that the sole office of the indicator is to measure and record pressure; actions which are commonly said to be revealed by the indicator are really inferences based on the pressure or on changes of pressure."

Locomotive Jacks.

A fair share of locomotive jacks get a poor show from the men in charge of them, so that when they are needed in case of a break-down on the road, they do not give good service. When they are carried on the back of the tender and get wet, it is only a short time before the threads are so rusty that it takes as much power to turn the screw in its case as to lift the weight of the engine or tender.

When a jack gets rusty, pour a dose of kerosene oil over it, let it soak a few minutes, if you have time, and set fire to the oil and flash it off. This will scale off rust and loosen up screw in its case without heating it enough to do any damage.

The best way to care for engine jacks when there is no special box to keep them in, is to oil them well, run the screw out and in to be sure it will work. If the bottom of the jack is not capped over to hold oil around the thread, put a wad of old, sticky waste out of a car journal box in the bottom and jam it around the screw into the threads, so it cannot work out; this will keep the oil in and the water out.

When you get ready to take a jack out from under a load, run the screw down so you can lift it out by hand. Do not try to hurry up matters by moving the engine and tipping the jack out loose; the screw is sure to be sprung so the jack is useless afterward. It does not take much strain on a jack, if it is not resting squarely on the bottom, to spring the screw so it cannot be used. Look out for this.

NEW ZEALAND CRANE FOR HANDLING COAL AND CINDERS.

Snap Shots on the Road.

Owing to the perversity which sometimes overtakes cameras or films, none of the views snapped from the rear end of the Queen & Crescent train were satisfactory. It would need a biograph to do the subject justice, for the ever changing scenery and the ups and downs as one 60-foot grade succeeds another, make it extremely interesting.

The observation end on the diner gives a good chance of seeing the country, and here I had the pleasure of meeting Mr. M. W. Maguire, division superintendent at Somerset, and Mr. J. W. Hood, trainmaster at Lexington. The diner itself is one of the things to be remembered, as the service was good—a-la-carte—the portions large and the prices reasonable. It was my first trip through the blue grass country and was all interesting. I tried to get good views of a few of the twenty-seven tunnels between Chattanooga and Cincinnati, but without entirely satisfactory results.

Leaving Cincinnati and crossing once more to the Kentucky side, the Chesapeake & Ohio road follows the Ohio river for about 160 miles, then turns and makes a dash at the Blue Ridge Mountains of West Virginia. The scenery in these mountains is grand beyond description, and as curve, tunnel and grade follow each other in quick succession, the view changes from precipitous cliffs to green fields and orchards rolling away for miles to other mountains in the distance. This is a great apple country—this portion of West Virginia—and in fact the land seems admirable for farms of any kind in between the mountains.

The small group of four views was taken from the rear end of the train, the first three at a high rate of speed. The cabin shown in the first view is on the side hill just below the railroad, and in the distance other mountains can be seen dimly. The other two show stone ballast and a good roadway at close on to 60 miles an hour.

The last one was snapped just as we pulled through a little town in Virginia, where an old mammy was selling small cakes and other edibles. She caught sight of me as the train was gaining speed, and I caught a faint murmur of "Dat's wurf a nickel, boss."

Virginia shows the traveler a vast array of beautiful fields, apparently well cultivated and prosperous. This is historic ground, too—and Culpepper, Manassas and Bull Run (a little stream from which the battle was named in the North) awake vivid memories of the misunderstanding of nearly forty years ago. The brakeman adds to the realism by pointing out some of the Confederate earthworks which still remain in silent testimony of the stirring events of so long ago. Right on the dot we pull into Washington, and a beautiful ride is ended on time. C.

ALONG THE CHESAPEAKE & OHIO RAILROAD.

Active Yankee Achievements.

The ability and alacrity with which the modern Yankee takes up big schemes and pushes them to a finish is the wonder of the civilized world. About a year ago one of the great British railway lines found itself in immediate want of a large number of locomotives. English locomotive builders assured the railroad that it would be an impossibility to supply the locomotives—that months instead of weeks would be necessary to construct them. An American firm, however, built the locomotives and had the last one shipped before the expiration of the few weeks' contract time.

A large steel bridge was needed quickly in a foreign country. European manufacturers declared it a physical impossibility to build a bridge in the time given. An American agent, who was bidding on the bridge, cabled his firm in Philadelphia, asking for advice. "We'll build bridge in seven weeks," was the firm's reply. The agent was astonished and thought a mistake in the wording of the telegram had been made, and so cabled the firm. The reply came back: "No mistake. We'll build bridge in seven days if required." In less than seven weeks the bridge was finished and shipped—the wonder and talk of the manufacturing world.

But the shipment of the entire equipment of a trolley road on an express train is an achievement which towers above the others for quick action. That is what the Larchmont Railroad Company did the other day, says a New York daily paper, as follows:

"Larchmont is the home of many millionaires of New York, and they recently decided that they wanted an electric railway system. So President Charles Singer, of the company, was given until June 1st to construct the road under the conditions of the franchise. President Singer was equal to the emergency, so he telegraphed to a big steel works in Reading, Pa., ordering Larchmont's new electric railroad.

"'Send it quickly as possible,' said he, in closing the order. 'The freight trains are too slow. Put it on a fast express.'

"Fifty tons of rails, 700 fancy painted trolley poles and a full quota of switches and other equipment were loaded on cars. As the cars had to be attached to the fastest trains containing parlor and drawing-room cars, the Pennsylvania company furnished its most elegantly equipped baggage cars, the red mahogany ones, with the letters 'Pennsylvania Limited' painted in gold on the sides.

"The special cars containing the railroad came from Philadelphia to Larchmont on the fast 'Colonial' that goes through from Washington to Boston every day *via* the Harlem River branch of the New Haven Railroad."

The Hayden & Derby Manufacturing Company, 85, 87 and 89 Liberty street, New York, have just issued a new catalogue (standard size, 9 x 12) of twenty-eight pages, illustrating the Metropolitan 1898 locomotive injectors. It shows the various types which they manufacture, gives specifications as to sizes of pipe connections and details as to repair parts. The H-D locomotive strainer, the H-D combined stop and check valve, the H-D swing, intermediate and line check valves, main steam valves and main boiler check valves are also shown. In addition to the usual price list and pipe connections, there are tables of capacities with various temperatures of feed water, range of capacity with various steam pressures and various temperatures of feed water, which is especially interesting to railroads and railroad men, now that the subject of heating the feed water is being so generally discussed and advocated. They will be pleased to mail a copy on application.

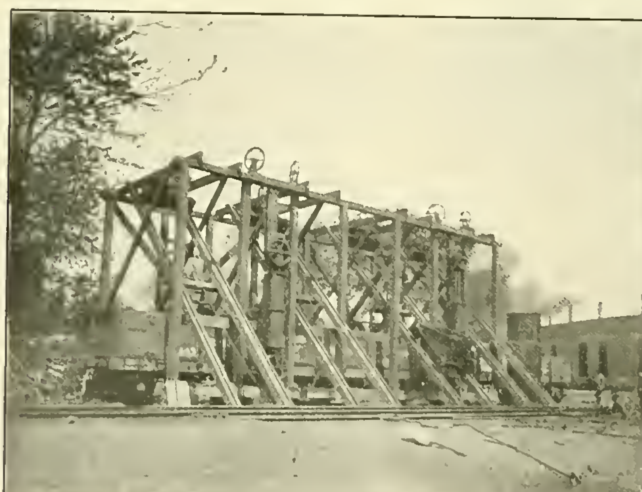
New Roundhouse of the Chicago & Northwestern at Clinton, Iowa.

Our readers will be interested in the following letter from Master Mechanic Bentley, giving the details of what may be the largest roundhouse in the world. He writes:

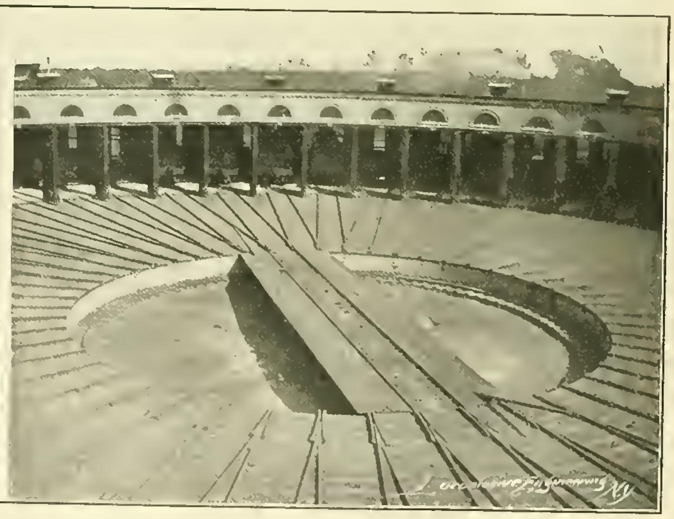
We have just moved into the new roundhouse, built by the Chicago & North Western Railway Company at Clinton, Iowa, and as it is said by some people to be the largest roundhouse in the world, thought perhaps a little information about it would be of interest to a number of your readers.

CHICAGO & NORTHWESTERN ROUNDHOUSE CONSTRUCTION—LARGEST IN THE WORLD.

The first ground was broken August 14, 1899, and the engines and men moved in May 14, 1900; so that the work, which was done by and under the direction of our superintendent of bridges and buildings, Mr. W. D. Walden, only took nine months.



PNEUMATIC ASH HOIST—CAR GOING UP.



VIEW OF CIRCLE AND TURNTABLE FROM ROOF.

CHICAGO & NORTHWESTERN ROUNDHOUSE, CLINTON, IOWA.

Mr. Walden, who is seventy-five years of age, has worked for the Chicago & North Western Railway Company for the past thirty-seven years, and is an indefatigible worker, the roundhouse and shops being a monument to his ability. A few particulars are here given:

Number of stalls—48; including entrance and exit, 50; a complete circle.

Radius of outside wall—187 feet 6 inches.

Radius of inside wall—106 feet.

Clearance between walls inside house—81 feet 6 inches.

Length of longest engine and tender, complete—62 feet 8½ inches.

Turntable—70 feet long, set on solid rock foundation, to be operated later with electricity.

Water is obtained from an artesian well, 1,175 feet deep.

Drop pits cut out of solid rock.

Size of machine shop and storeroom—60 x 140 feet.

Roundhouse, machine shop and storeroom heated throughout with the Sturtevant hot-air system.

Have sent you a few views of the place showing the pneumatic ash hoist, which was designed by our assistant superintendent of motive power and machinery, Mr. G. R. Henderson, and which works very satisfactorily. In looking over the ash hoists already at work, Mr. Henderson saw the need of one that could be operated from the pit and that would be automatic so far as dumping the cinders and closing pan lid were concerned. Our present hoist is the outcome of his work in this direction, and, as before stated, works very satisfactorily.

H. T. Bentley, M. M.

Draft Without a Chimney.

A very intelligent engineer who was in this office a few days ago was looking over our June number and his attention became attracted by the advertisement of the B. F. Sturtevant Company, headed "Draft without a chimney." "Now," he remarked, "there is one of our latter-day fads. What is the matter with a chimney? It does its work day in and day out, costs nothing to speak of, and is always ready for business. I have no use for the people who are agitating to abolish useful things." We answered that there were two sides to this question, and although we could not at once produce proof about the wastefulness of the chimney there were good reasons for believing that it was an expensive means of producing draft. Since then we have been searching our note books, and we find the following remarks taken from a report made on furnaces by Mr. Charles Fairbairn, a celebrated English engineer. In the course of it he said:

"The indispensable conditions attached

to a good furnace, for all kinds of fuel, are:

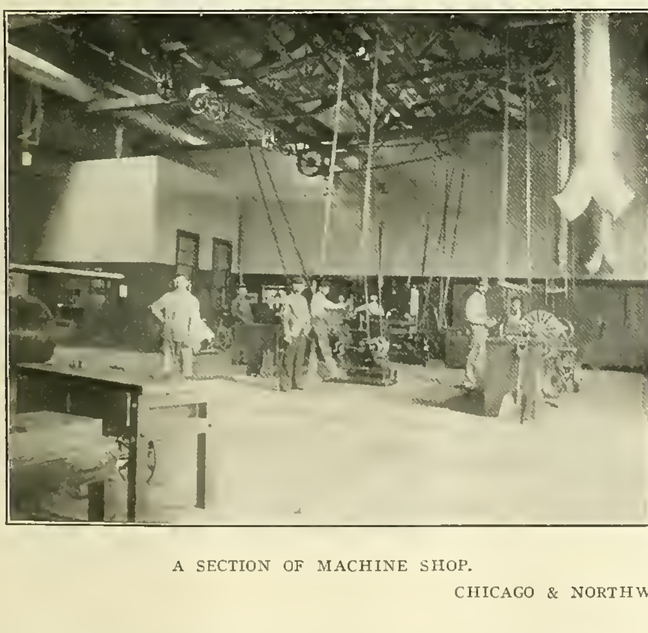
"First—A good draft, which can be regulated at will, so as to avoid forcing the fire too much.

"Second—A large and roomy combus-

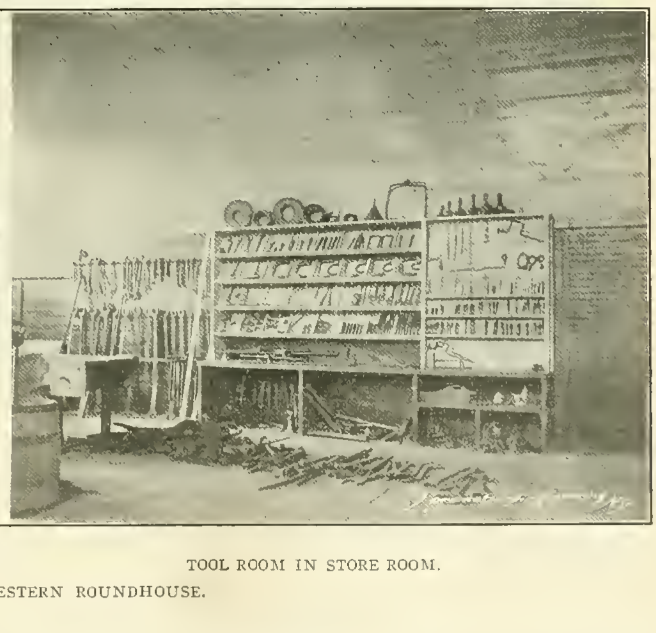
VIEWS SHOWING CLEARANCE, BACK AND FRONT, OF LARGEST ENGINES—CHICAGO & NORTHWESTERN ROUNDHOUSE.

tion chamber, surrounded by fire bricks, and removed, if possible, from the place where the neat is to be used.

"Third—That the sides or walls of a furnace have at least ten thicknesses of bricks nearest the fire, and an outer wall having an air space between of about 3 inches.



A SECTION OF MACHINE SHOP.



TOOL ROOM IN STORE ROOM.

CHICAGO & NORTHWESTERN ROUNDHOUSE.

"Fourth—That the supply of air to the furnace can be regulated at will.

"I do not think we can always command these conditions, especially in a furnace constructed on the principle of depending on atmospheric pressure for draft; and the reason is obvious, because in order to obtain a good and equal draft we require not only a tall chimney, but the chimney must be maintained at a high temperature, about 600 degrees; and as the tempeature within the furnace may be assumed at 2,500 degrees, the abstraction of this large quantity of heat to keep the chimney at a sufficiently high temperature amounts to one-fourth of the heat, and consequently of the fuel which is expended for that purpose alone. Nor is this the only drawback. The attendant on the furnace, who may have, and often has, other duties to perform, puts on a heavy load of coal. The flues and chimney are rapidly cooled and power of draft reduced at the very time when it should be greatest."

A table was lately published by the *Railroad Gazette* giving particulars of the railroad mileage in all the countries of the world where railroads are in use. The recapitulation makes a total of 466,539 miles, being made up as follows: Europe, 167,510; North America, 212,848; South America, 27,188; Asia, 33,289; Africa, 11,214, and Australia, 14,490 miles. The particulars were for the end of 1898.

The Economy of Speed.

BY F. P. ROESCH.

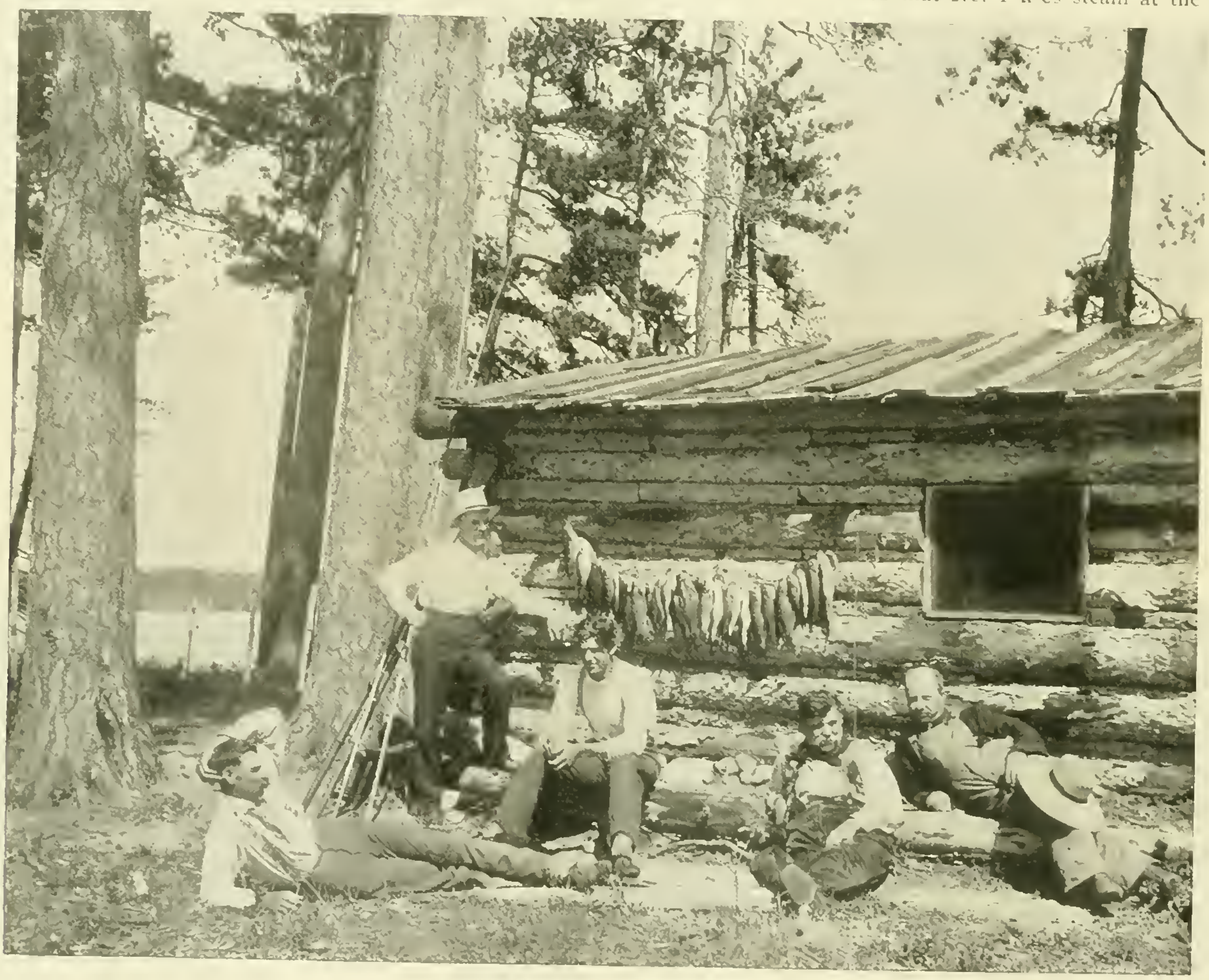
While employed on a prominent railroad some years ago the road changed management. The policy of the former management was to rate freight engines at a tonnage that could be handled at the rate of from 15 to 20 miles per hour; the later management rated engines at all they could drag, time or speed not being taken into consideration. The question naturally arose, which policy was the most economical?

The freight engines on this road were 20 x 24-inch consolidated, with 60-inch drivers.

By practical tests we found that with a train of 700 tons, we could maintain an average speed of 17½ miles per hour, working engines at about one-third stroke —i. e., 8-inch cut-off—while with 100 tons added, we could only average about 10 miles per hour, although engines were worked at from half to two-thirds stroke, or from 12 to 16 inches. These figures consequently were taken on which to base our calculations. We have, therefore, the following basis to work on:

A road or division of 150 miles; engines that will haul 800 tons at two-thirds stroke at an average rate of 10 miles per hour, or 700 tons at one-third stroke, at an average rate of 17½ miles per hour; size of engine, 20 x 24 inches; 60-inch wheel.

Axiom—An engine tied up at terminals for work or other causes earns no revenue. Ergo—The same axiom applies to engines lying on side tracks waiting for other trains to pass, etc.



CAMPING ON TOMAHAWK LAKE.

With heavy trains running very close, good meeting points cannot always be made, especially where sidings are few and far between. Every hour thus spent on side tracks means the consumption of a certain quantity of fuel, the waste of certain quantities of oil, which, especially in warm weather, is bound to run off, etc. Not only this, but it means a waste of that which is far more precious—time.

We will now take two of our engines, which we will designate as engines No. 1 and No. 2, giving engine No. 1 a train of 800 tons, and engine No. 2 one of 700 tons.

Eliminating the fact that No. 2, with the lighter train, can make better meets than No. 1—which is giving No. 1 the best of the argument—and assuming that each train can pass over the road uninterrupted, we find that No. 1, running at the rate of 10 miles per hour, is 15 hours going over the division, while No. 2, whose speed is 17½ miles per hour, uses 8½ hours to go the same distance, a clear saving of 6½ hours in favor of No. 2.

As engines on arrival at terminals generally require more or less work, before going out again, we will suppose that each engine is held 7 hours for necessary repairs. This is again giving No. 1 the best of it, as will be shown later.

Starting both trains from the same terminal, at the same time, we find that No. 2 is ready for the return trip 30 minutes after the arrival of No. 1, and at the end of 24 hours we find that No. 2 is again at the other end of the division, while No. 1 has made but 20 miles on the return trip.

Thus we have handled with No. 1 1,600 tons 170 miles, and with No. 2 1,400 tons 300 miles. Reducing this to a ton-mile basis, we find that No. 1 has made 272,000 ton-miles and No. 2 has made 420,000 ton-miles in 24 hours, again of 148,000 ton-miles, or 54½ per cent., in favor of No. 2.

Thus we see that we obtain 54½ per cent. more work from No. 2 than from No. 1. Now let us see how they compare in fuel:

Having the size of the cylinders and the point of cut-off, we find that No. 1 uses $20 \times 20 \times .7854 \times 16 \times 4 = 20{,}106.24$ cubic inches of steam per revolution, while No. 2 uses $20 \times 20 \times .7854 \times 8 \times 4 = 10{,}053.12$ cubic inches. As each engine makes 336.3 revolutions per mile, No. 1 would consume $20{,}106.24 \times 336.3 = 6{,}761{,}728.5$ cubic inches, and No. 2 would use $10{,}053.12 \times 336.3 = 3{,}380{,}864.2$ cubic inches per mile; but as No. 2 makes 1¾ revolutions, while No. 1 makes one, we find that No. 2 uses steam four-seventh times as fast as No. 1; consequently, bringing the question down to a time basis, we find that No. 1 uses steam at the rate of 67,617,285 cubic inches per hour, and No. 2 at the rate of 59,165,123.5 cubic inches per hour—a gain in favor of No. 2 of 8,452,161.5 cubic inches of steam per hour, or 12½ per cent. It takes coal to make steam.

Assuming that a pound of coal in No. 1 will evaporate as much water as in No. 2, and as No. 2 uses 12½ per cent. less steam per hour than No. 1, it must follow that No. 2 burns at least 12½ per cent. less coal than No. 1 in the same period of time.

There is no denying the fact that, within certain well defined limits, there is economy in speed. I can refer to a very able article on the subject in the editorial on page 112, LOCOMOTIVE ENGINEERING, March, 1900.

Mr. S., a prominent superintendent on one of our Western roads, once informed the writer that whenever there was a congestion of traffic on his divisions, and he had but a limited number of engines at his disposal, he invariably cut down the tonnage of his trains, as in this manner only could he clear up the road; and it was an acknowledged fact that this gentleman accomplished more with less engines than his neighbors did with a much greater number.

Having endeavored to show that we can by a reduced tonnage rating, where rating is excessive, obtain 54½ per cent. more work out of an engine with 12½ per cent. less fuel, we will now consider the subject of engine maintenance by the two different methods of rating engines.

In riding over the road with different engineers you will notice that all have a favorite notch—the notch they delight to work their engines in.

"Here is where she does her best work," they say. If for any cause, such as an unusually heavy train, they have to drop the lever lower, they kick, with the remark: "Guess they want me to tear her all to pieces. Well, I can stand it if they can." "They" with a road man means everyone connected with the movement of trains. This is not a fad with engineers; it is the lesson taught by experience. Every man who has run an engine any length of time knows that there is a certain notch in the quadrant, or, in other words, a certain point of cut-off, where an engine does better work, does it easier, pounds less and burns less coal than at any others.

There is a reason for this. The locomotive is a machine designed to develop a varying horse-power, and to run at various speeds, according to load, grade, etc. No locomotive has yet been built that will do equally good work in the different points of cut-off. What is meant by that is, an engine that will handle a certain tonnage at a certain speed, cutting off at one-third stroke, will not handle an increased tonnage at the same speed when cutting off at two-thirds or three-fourths stroke, providing that the former tonnage was the correct rating for that speed and cut-off, as the nozzles, steam ways, etc., can accommodate but a certain quantity of steam in a given time. Yet the engineer, in his endeavors to make time, even when knowing that his engine is overloaded, will naturally drop his lever down, give the engine more throttle, etc., and in this manner tear up the fire, waste fuel, and rack his engine in every bearing. Theoretically, it should make but very little difference at what point of cut-off an engine is worked, but in practice we find it does, and that considerable.

In the May, 1899, number of LOCOMOTIVE ENGINEERING, page 209, Mr. T. P. Whelan, in explaining why a locomotive always pounds more on the left side, showed how the right side of a right lead engine, working in forward motion, took up the lost motion in the left side in the direction opposite the steam thrust on the piston at each end of the stroke.

This explanation is eminently correct, but does not always obtain under all conditions. There is a point of cut-off where the compression at the end of the stroke so balances the reciprocating parts that the lost motion is taken up on the left side by an easy, partly rotative, partly direct, movement, that the bearing surfaces on box and journal are brought to their respective positions against shoe and wedge to receive the thrust from the piston, without that spine-breaking kick which is developed at other points of cut-off.

This is the engineer's favorite notch, and found only in actual service. This will also be found to be the most economical point of cut-off, not only as to wear and tear of machinery, but also in fuel, oil, etc., and a train that can be handled in this notch will be found to be

LONE ROCK—LOWER DELLS.

the most economical load that can be put behind the engine.

This may seem a queer assertion, but put it in practice and you will find it will give you a fair tonnage rating for a speed of from 15 to 20 miles per hour.

It is hardly necessary to say more; the fact is too evident and well known, that the overloaded engine requires more repairs and will be worn out much sooner than the one loaded to a fair rating.

Maintenance of power is quite an item in the operation of a railroad. By allotting a fair tonnage rating a low maintenance expense will naturally follow, but where the spirit of economy dictates the overloading of engines, and at the same time calls for a reduction in shop expenses, the lot of the motive power department is sad indeed.

"The Mechanical Equipment of the New South Station, Boston, Mass.," is an interesting illustrated pamphlet by Walter C. Kerr, of Westinghouse, Church, Kerr & Co., New York. This was presented to the American Society of Mechanical Engineers last December, and attracted wide attention. Every railroad man is interested in the equipment of one of the largest stations in the world and will want a copy. We believe one will be sent on application.

Summer Days in the Lake Country.

The above is the title of a very handsomely illustrated book recently published by the passenger department of the Chicago, Milwaukee & St. Paul Railroad. While sitting in a hot office looking over this book imagination almost makes us cool, for we are borne away to rushing streams, crystal lakes and shady woods, where a short sojourn would shake off the dust of mental and physical attrition that collects during a long season's devotion to business. Descriptions of attractive places for a summer outing can be made highly interesting; but there is nothing like good half-tone pictures for stirring ambition to hie towards the scenes depicted. "Summer Days in the Lake Country" is profusely illustrated by half-tones reproduced from photographs—the kind of pictures that cannot lie.

Persons who go to any of the health-inspiring resorts on the Chicago, Milwaukee & St. Paul may feel assured that they will enjoy a pleasant journey, if a smooth roadbed, luxurious, easy-riding cars and endless change of beautiful scenery will help to make them feel comfortable. We reproduce three pictures from the book, which will give an idea of what a book of seventy-three pages must be with a picture on nearly every page. We would advise those thinking of taking a summer outing to send for this book. They will get it by applying to George H. Heafford, general passenger agent, Chicago.

THE JAWS OF THE DELLS.

Don't Drop It.

Mr. P. Murray lives on Long Island, and, like thousands of good engineers, he takes LOCOMOTIVE ENGINEERING regularly. His subscription ran out the other day before he had time to renew it, and the red card with the "Don't Drop It" legend reached his postoffice in due time. Willie Murray goes for the mail and brought home the red card among the rest. Mrs. Murray had just read about a dynamite explosion when Willie came in with the card accidentally lying on top of a small bundle, and his mother caught sight of it. "Willie, Willie; take that right out doors to your father, and don't drop it," she exclaimed, as visions of a wrecked household danced before her eyes, and Willie and his father haven't got through laughing yet.

The Q & C Company, Chicago, Ill., send us two interesting catalogues. One is on metal sawing machines, and the other is about their pneumatic tools. As usual with their catalogues, they are well illustrated and printed, and give detailed descriptions of their well-known tools.

THE LARGEST LOCOM

Cylinders—24 x 32 inches.

Drivers, diameter—54 inches.

Boiler at throat sheet—88 inches.

Length of engine—41 feet 1½ inches

Length of engine and tender—68 feet.

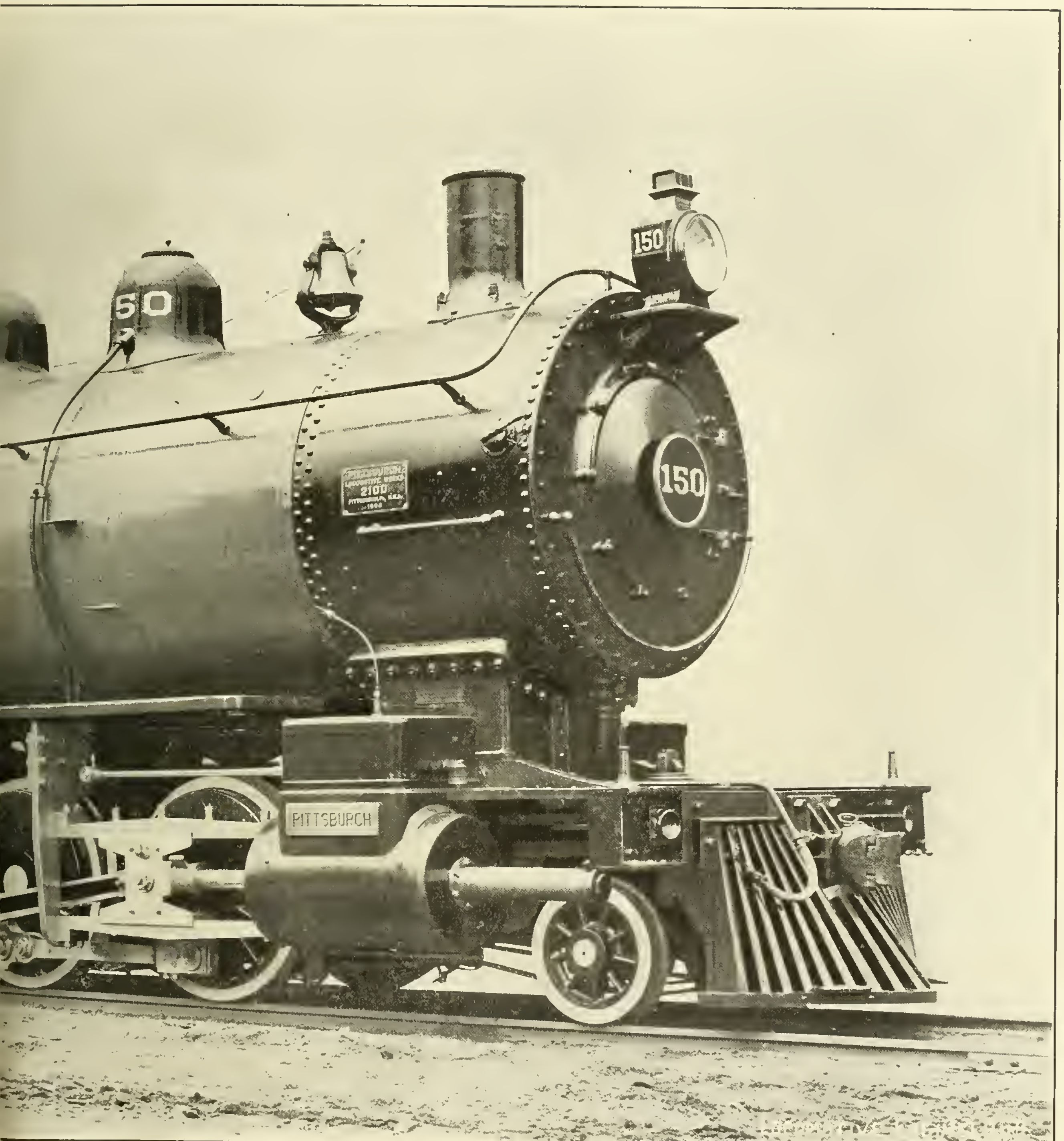
Steam pressure—22

Heating surface—3,

Grate surface—36.8

Tank—7,500 gallons

Height to top of sta



TIVE IN THE WORLD.

ıds.

ıare feet.

e feet.

, 14 tons coal.

5 feet.

Weight on truck—25,100 pounds.

Weight on drivers—225,200 pounds.

Weight of engine—250,300 pounds.

Weight of tender—141,100 pounds.

Weight of engine and tender—391,400 pounds.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Old and New Methods of Holding Trains on Mountain Grades.

We illustrate herewith records taken from a freight train descending steep grades on a Western ore road. The records show graphically the advantage gained by the use of retaining valves and by making frequent recharges.

The speed lines show, in a measure, the operation of the brakes or the frequency of the applications.

Beginning at the right and reading to the left, the rise in the line denotes increase in speed caused by the release of brakes, the retainers, of course, being in service.

The drop in the line shows decrease in speed, caused by brake application.

The lowest speed points at which brakes are released show to a great extent how well the retainers are holding; for the less pointed the lowest speed point is, the better the retainers are holding; and the more pointed the lowest speed point is, the less the retainers are holding.

Print No. 1 shows what can be accomplished without the use of hand brakes when the braking power is low in relation to weight of train, by keeping the maximum speed down. In this case the brake applications were frequent, and while the initial reductions were heavier than in speed record No. 2, the total reductions were less.

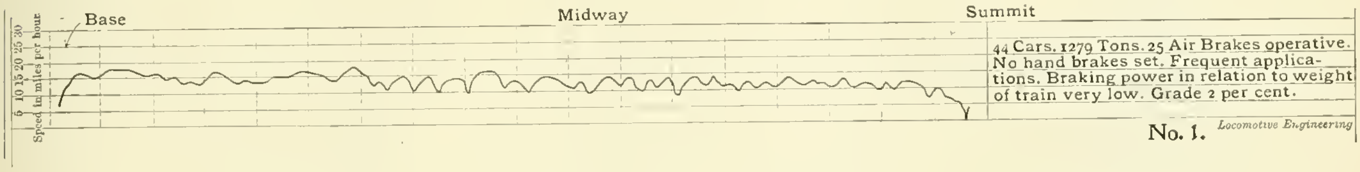
The initial reductions on speed chart No. 1 were heavy enough to bring the speed down rapidly, consequently the brakes were not held on so long as shown on chart No. 2. This resulted in operating the brakes at a higher efficiency; for the shorter the time the brakes are held on, the less liability there is of brakes leaking off, less train-line leakage, and consequently less time is required for recharging.

The shorter the time required for recharging, the less liability of retainer leakage, and the practice of making more frequent applications develops a higher cylinder pressure due to that fact.

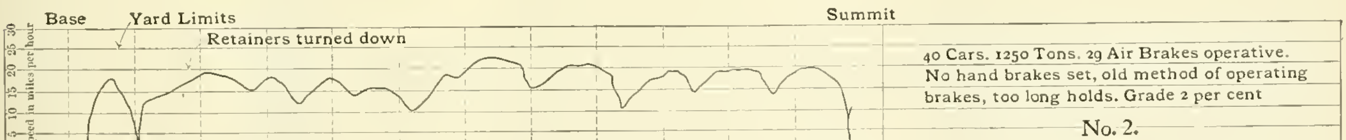
Speed charts Nos. 2 and 3 were taken from the same engineer. No. 2 shows the old method of operating the brakes—few applications and the brakes held on as long as possible. This results in a very uniform rate of speed, and a curve is depended on to reduce the speed low enough to permit of releasing to recharge, and owing to the long time the brakes were held on the train line and auxiliary reservoir pressure is low; consequently, much time is required in recharging, and a comparatively high speed is attained before that is accomplished.

Chart No. 3 shows frequent applications, and, like No. 1, the initial reductions were heavy enough to reduce the speed rapidly.

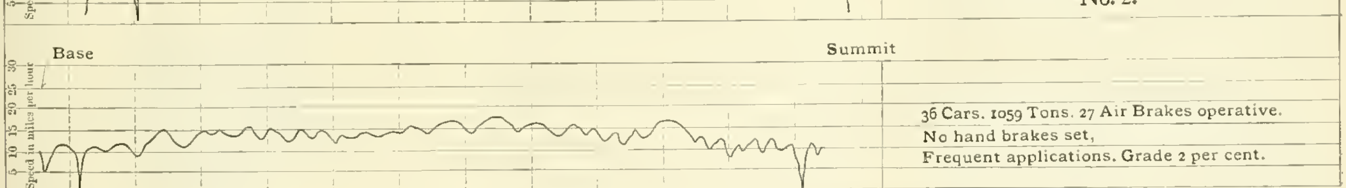
The recharging was done with brake valve (F-6) in full release position. Engines were fitted with 9½-inch pumps and main reservoir capacity of about 34,000 cubic inches.



No. 1. *Locomotive Engineering*



No. 2.



No. 3. *Locomotive Engineering*

Good Time Saving Device.

A novel idea concerning air-brake appliances has been conceived by one of the crew of Philadelphia division cabin No. 190,600, Pennsylvania Railroad, says the *Pittsburgh Post*, and is being tried on the above cabin as follows: The cabin was first equipped with air pipes and hose, after which a small pipe was connected to the train pipe and extended from the bottom of the cabin to the skylight of same. A small air gage was then attached to this pipe and by opening a small cock connected to this gage the men in the cabin are thus enabled to see how much air pressure is registered by the gage in the cabin of the engine.

If any of the air hose should burst on the train, or any of the angle cocks become closed, they can trace up the cause with less delay and trouble than heretofore. When a leak or failure in air was apparent, the men were compelled to go to the engine, sometimes a distance of half a mile, to ascertain the cause, but by this new arrangement they are better enabled to trace any leak or failure from the rear of the train, thereby reducing the amount of delay to a minimum. This idea has been commented on as being very good and may be adopted by some of the railroad companies.

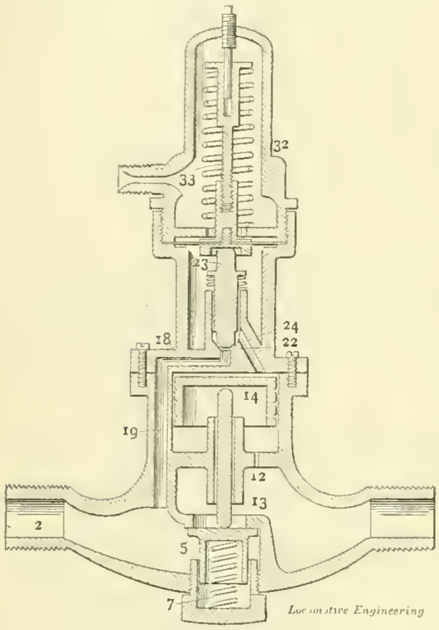
This scheme of placing an air gage in the caboose and connecting it to the train pipe and auxiliary reservoir pressures is a good one, but is not new. The Western roads have used it several years—in fact, ever since they began running all air-braked trains. The novelty and advantage of watching the pressures through the medium of the gage will encourage all air cars in the train to be coupled up.

The proceedings of the Seventh Annual Convention will be ready for distribution about July 25. The price for leather bound copies is 75 cents; paper bound, 50 cents. Send in your orders early—don't wait until they are all gone.

Automatic Throttle Valve and Governor

Following is the description of a recently invented automatic throttle valve and governor:

The pressure chamber may contain water or air. In the case of hydraulic elevators and the like it would contain water, whereas in the case of railway brakes it contains air. In its normal position the spring 7 closes the valve 5, which, acting on the stem 13, raises the piston 14 and



AUTOMATIC THROTTLE VALVE AND GOVERNER.

closes the port 24. The spring 32 raises the diaphragm from the path of the valve 23, and its spring 26 raises said valve from its seat 22. Communication being established between the boiler and the inlet 2, the live steam passes into the valve and through the ports 19, 18, past the valve 23, and thence downward through the port 24, where it exerts a pressure on the piston 14, forcing it downward, and through the medium of its stem 13 unseating the valve 5, and thereby allowing a direct passage of the steam to the steam cylinder of the pump, which begins storing up the pressure in the pressure chamber, and as soon as the desired pressure has been attained, and which corresponds to the tension exerted by the spring 32 on the diaphragm, the pressure in the tank being communicated to the pressure chamber 17 and acting on the diaphragm overcomes the tension of the diaphragm spring, and thereby forces the diaphragm downward, which closes the valve 23 and takes the pressure off of the piston 14, the steam contained in the piston chamber passing through the orifice 12, whence it passes outward to contribute its share of power to operate the pump. The pressure now being removed from the face of the valve 5, the spring 7, augmented by the pressure of the steam on the back of the valve, closes it, and thus cuts off communication between the boiler and the pump. As soon as the pressure in the pressure tank falls below a given point, or below the pressure exerted by the spring 32 on the diaphragm, the latter rises under the influence of its spring, and thereby permits the valve 23 to unseat, and thus admit live steam to the piston 14, with a like result to that heretofore set forth.

Further information may be had by writing to the inventor.

A Praiseworthy Project.

A corre pondent writes us that he has turned a portion of his home into an air-brake instruction room, in order that he and his fellow workers may acquire a better understanding of the air-brake system. This is certainly a praiseworthy move, and should be so recognized by the officials of the road in some substantial manner—say, the equipment of a modern air-brake instruction plant for the men. We have learned of men taking the brake valve off the engine and the triple valve off the tender, the parts being carried home every night to be studied; and we know of the man who carried his instruction book and chart with him to church, and while his wife was scrutinizing the new bonnets and napping during the prosy sermon, the man studied out and learned the operation of the quick-action triple valve; but the man who turns his home into an air-brake instruction room for the use of his friends and ultimate betterment of the service on his road, should be placed at the head of the list.

The Allegheny Valley Railroad Air-Brake School.

The Allegheny Valley Railroad has opened its new air-brake instruction room for the benefit of the employés, and, generally speaking, it is one of the finest equipped rooms in the country, says a Pittsburgh paper. Every part of the air brake and train signalling is shown in cut sections, in order to demonstrate to all concerned the nature of movements of the different parts. Many new and original ideas have been evolved in the construction of this room.

The equipment includes twelve freight cars, eight passenger coaches and an engine and tank. Good results are what the road is aiming at, and there is no doubt but that the instruction given, relative to air-brake equipment, will be recognized as a successful enterprise in the near future.

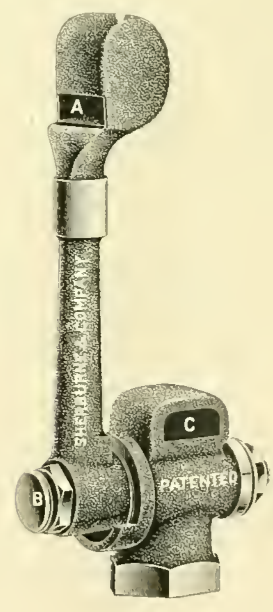
Mr. C. L. McVicker, the traveling engineer, is also air-brake instructor.

A communication, signed Chas. A. Hegg, Parsons, Kan., came to us recently, and we replied at length by private mail. The letter has been returned to us unclaimed. The writer may have it by sending his proper name and address.

Brakeman's Back-Up and Signal Valve.

The modern methods of handling trains between terminal points and in passenger yards have entirely changed conditions from those which existed in the days when switch crews and engines attended exclusively to this work. Consequently it has become largely the practice that trains be backed into the station by the engine which hauls the train. These conditions make it necessary that provision be made whereby the train may be positively controlled from the rear end, as the engineman is so located that he cannot attend to this service in an effective manner. It is also found that some substitute must be used in place of the engine bell, as a warning in passing into or through depots or yards.

The accompanying cut shows a device which is designed and manufactured by Sherburne & Co., of Boston, Mass., to fulfill these requirements. It is a combined plug-cock and alarm whistle *A* attached by a short length of hose or pipe to the train pipe of the rear car. The whistle is blown by pressing the button *B* shown in the cut. This allows air to pass through the hollow handle of the cock to the whistle, which is shown on the end of the handle, blowing the same and giving the necessary alarm. The air used for this purpose, on account of the design of the



BRAKEMAN'S BACK-UP AND SIGNAL VALVE.

whistle valve, positively does not affect the brake system.

By moving the handle of the cock in either direction, exhaust is made from the train pipe through opening *C*, the brake set, and control of the train given.

This device is also valuable in backing up, switching with freight trains, especially during the night or in thick weather, as the train by its use is under control from both ends.

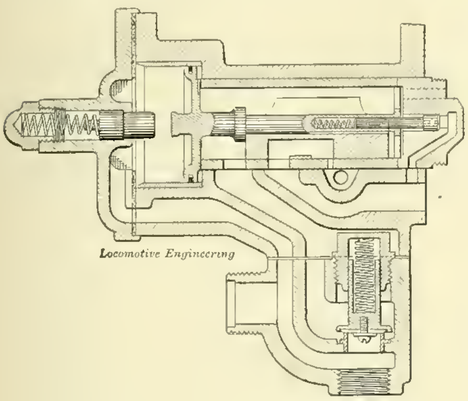
CORRESPONDENCE.

Two Air Pumps for the Locomotive.

Editor:

The increased use of compressed air in modern train service brings us face to face with the new difficulty of "How can the air be best supplied?"

Trains are lengthening, and the brake is possibly the important feature of the train, so that it is absolutely necessary to provide sufficient air for this first, regardless of auxiliaries. For this the air pump has proved its value in many ways in spite of its lack of economy in steam consumption, and it will probably continue to supply air for braking purposes. The air taken for signals, for sanding, for bell ringing and for raising water in the passenger cars is considerable—more than many imagine—and must be provided for. An independent pump seems best for this, but the steam driven air pump would hardly be recommended, in spite of its many valuable properties, for braking service.



RECENTLY PATENTED TRIPLE VALVE.

Would it not be better to use an independent pump—driven from the axle or crosshead—for this purpose, pumping into a reservoir, with safety valve and by-pass? Then, when desired pressure was reached the by-pass would open and the pump have no work to do until pressure fell. I believe this would be better and cheaper in every way than either increasing main air pump or using a separate one for this purpose. A pump of this kind will run for a long time with very little repairs, and will be sure to give good service. It will also relieve the main pump from auxiliary duties and leave it entirely for braking, as it should be. I. B. Rich.

Honeybrook, Pa.

A Possible Cause.

Editor:

F. L. Dillon makes a reasonable statement in May number, in answering A. D. W. in question No. 30, March number; but I consider his trouble is a weak graduating spring. His train line being short, the graduating port through slide valve will not reduce auxiliary reservoir as fast as engineer's valve is reducing the train line. Now, owing to the weakness of graduating spring the triple moves to emergency position, and when the auxiliary becomes less than train line, both piston and slide valve have to move in order to stop the flow from auxiliary to cylinder, and instead of slide valve stopping when in proper place to hold brake on, it returns to release position. Let A. D. W. couple on to a few cars, say six or more, with air brakes, and see if his brake will release when he makes an application; I don't think it will. If he will put in a small washer or two to shorten and strengthen the graduating spring, he will overcome his trouble. With this trouble, if he reduces the train line to 40 pounds or less, his brake would not release. I have applied this cure with success.

Joe Callin,
Canadian Pacific Ry.

Kamloops, B. C.

We note with pleasure that nearly all correspondents are now signing their names and addresses, as we recently requested, which enables us to communicate with them, should such be necessary.

Regarding Back-Up Hose.

Editor:

Referring to the cut of a good "back-up" hose illustrated in the May Locomotive Engineering, I am of the opinion that this idea is patented, as I remember, a few years ago, seeing correspondence from the patentee warning all users of the device without his permission that they would be prosecuted. The letter was accompanied with a cut similar to the one you show and also a copy of the patent as granted. This tip may be useful to some who are using the device without permission. Chas. C. Richardson.

Greenville, Pa.

One Reason Why the Equalizing Piston Remains Unseated.

Editor:

We often hear engineers complaining that the train line exhaust will not stop after a service application when the handle is placed on lap, and some report this and the other something else, and have the repair man looking for the trouble.

The air in passing through the brake valve, both going into and coming out of the train pipe, is inclined to leave a deposit of grease, gum and dirt on the walls of equalizing piston chamber, which, in time, gets so bad that it greatly retards the movements of the equalizing piston.

With this piston moving freely in a service application as soon as the train line pressure is slightly lower than the equalizing pressure it forces the piston down and seats the pin valve, thus closing the train pipe exhaust. But when the movement of the piston and valve is retarded by gum and dirt it moves down slowly as the equalizing pressure begins to overbalance the train line. At the same time a portion of the equalizing pressure is leaking by the packing ring in the discharge piston, and when the valve is near enough to its seat that the flow of air from the train line through it will equalize with the pressure on top of the piston, through the leak by the piston packing, there it will stop, and the reduction of train line pressure will continue unless by means of a sudden jar you can break the piston loose from the gum and allow it to go to its seat.

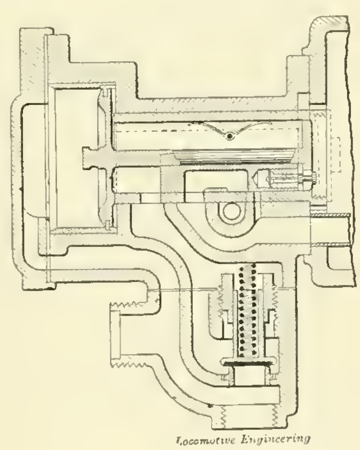
This trouble must not be confounded with a leak from the equalizing discharge pressure or a cut rotary valve seat in the equalizing discharge valve; for in either of these cases it will be impossible to stop the flow of air from the train pipe exhaust, while in the case of the gummed piston it may be completely shut off, either by a jar of the valve, by a short reduction in emergency application, or by placing the valve in full release and then returning it to running position.

If this condition is allowed to exist for any length of time it will grow worse, and will not only cause very poor braking, but the packing ring and the walls of the equalizing discharge chamber will become cut so that it will be necessary to renew these parts. F. L. Dillon.

Danville, Ill.

Mr. Robert H. Blackall gives in this number a valuable detailed method of cleaning and oiling brake cylinders and triple valves.

The recent employment of Robert H. Blackall by the Westinghouse Air-Brake Company will reduce the number of air-brake inspectors on the Delaware & Hudson, where Mr. Blackall has served for several years. Mr. Robert Cory, who has had charge of the northern part of that system, will now be given general supervision of the whole line.



RECENTLY PATENTED TRIPLE VALVE.

A Commendable Project.

Editor:

I am sending you two photographs of my air-brake corner at my home, in my dining room. I have a small instruction plant fixed up for the benefit of myself and the engineers, firemen and trainmen. My home is centrally located and the men have spent many pleasant evenings with me. Our road, the Toledo, St. Louis & Kansas City, has no instruction car or plant, so I give them instruction so far as I am able with the little plant I have at home.

NO. 1. AIR-BRAKE INSTRUCTION ROOM IN A MAN'S RESIDENCE.

In picture No. 1 you will see two devices I have to show piston travel and pressure. The one on the right-hand side, under one of my charts, is to represent a brake cylinder; the other one, on the floor in front, represents a reservoir. I have them painted black and white. I send the picture to show the interest we men take in air brakes and how we get instruction without a car or plant. The books in picture are all on Air. I always keep the Locomotive Engineering on hand for reference and authority. You will see them in picture. If you are not too busy, I would like to know what you think of my corner.

CHAS G. GREENE,
T., St. L. & K. C. Ry.

Frankfort, Ind.

[The interest shown by the other men and yourself in air brakes, and your desire to increase your knowledge therein, is certainly commendable. This private instruction room and its well-attended meetings should be the strongest kind of a hint to your officials to supply you with a more elaborate instruction room or instruction car.—Ed.]

Cylinder and Triple Valve Cleaning on Freight Cars.

One of the air-brake subjects which does not seem to receive its share of discussion is the cleaning and oiling of air-brake cylinders and triple valves. This is of great interest to air-brake men, both from a practical as well as from an economical standpoint.

Brake cylinders, as well as triple valves, are in much better condition when in constant use, and in order to be used they must be kept in good condition, and the air-brake cars in trains switched ahead.

Without doubt, it will be necessary for railroads to make a considerable outlay to maintain air brakes properly; but they will more than save the amount expended upon them in the saving of collisions, flat wheels and wrecks resultant from broken wheels due to the overheating of wheels with hand brakes.

Roads that are not looking after air brakes will find eventually, and to their sorrow, that it costs more to allow packing leathers to dry out and crack than it does to use an ounce of prevention once a year in the way of oiling and cleaning.

The object of this article is to call forth ideas from air-brake men in regard to cylinder and triple oiling and cleaning, the methods and tools employed, and any kindred information that will help to put this work on a systematic, practical and economical basis.

The accompanying sketches are of tools used by one road. If any of the tools are not as good as those used on your road, or you can improve on the methods described, criticise the article, send sketches of your tools, and the writer will feel that his object in writing has been attained.

I am satisfied that one man will do the work cheaper than two. The tendency for visiting is eliminated and, with one, there is not the chance for the quicker to get through his part first and have to wait for the other.

NO. 2. AIR-BRAKE INSTRUCTION ROOM IN A MAN'S RESIDENCE.

First, we take the triple to pieces, and all parts, except the rubber-seated valve, are immersed in kerosene. By the time the cylinder is cleaned, oiled, and its parts replaced, the kerosene will have softened the dirt and gum on the parts of the triple so that they can easily be cleaned and the triple piston packing ring made to work freely.

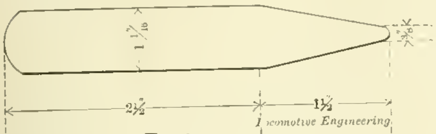


Fig. 1

A small board with nails driven into it is handy upon which to place the nuts from the cylinder and triple.

After the parts of the triple have been immersed in kerosene, the push rod is removed and a ¼-inch hole drilled through the piston sleeve close up to the cylinder hood. On cars with the brake cylinder fastened to the side sill, as on many coal and ore cars, a ¼-inch hole is also drilled into the bottom of the cylinder close up to the fillet at the hood end of the cylinder.

Fig. 2

This hole is so placed to allow any water accumulated to drip to the ground instead of remaining in the cylinder to freeze in cold weather. We find that rain strikes the piston sleeve and works back into the cylinder when there is no means of escape for it. The only objection to the hole is that oil may leak from the cylinder to the ground. We do not find this to be a drawback, as the oil is put into the cylinder on the other side of the piston and works by slowly, if at all.

A pin is now slipped into the hole drilled in the sleeve, and this serves to keep the release spring compressed when the cylinder nuts are removed. After removing the oil plug the piston is removed and the cylinder is thoroughly cleaned with waste saturated in kerosene. Care is used to free the leakage groove of gum or dirt, and the walls of the cylinder are then rubbed dry with chamois. A small quantity of West Virginia oil is now poured into the cylinder, and the hand is used to distribute the oil over the walls, especial care being given to the top. The expander

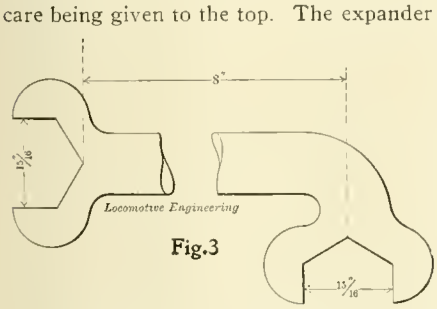


Fig. 3

ring is now removed and the piston and packing leather thoroughly cleaned; the groove for the expander ring is then partially filled with oil and the expander ring replaced. This last we consider a very important point which greatly increases the life of the leather. The opening of the expander ring should not come opposite the leakage groove, and care should be taken not to allow the same part of the packing leather to remain at the bottom of the cylinder.

The piston is now replaced and the head secured, after which a small amount of oil is poured into the cylinder through the oil hole; the oil plug is then secured in place. If too much oil is poured in through the oil hole, there being only a small clearance between the piston and back head, the oil extends above the pipe leading through the auxiliary to the cylinder. In such a case the oil flows into the triple and ruins the rubber seated valve, eventually rendering the triple useless. We have learned this by bitter experience.

The triple and its parts are now ready for cleaning. Kerosene is used, and care is exercised to remove all lint with a piece of chamois. The feed grooves, triple strainer and train line strainer should also receive their share of attention. No oil is used on the emergency parts for lubrication purposes, and as little as possible, rubbed on with the finger, is put on the slide valve, its seat, the triple piston packing ring and the bushing in which it works. The graduating spring is then tested and the parts replaced. In replacing the emergency parts the bottom case of the triple should be held firmly in place with one hand until one screw bolt is

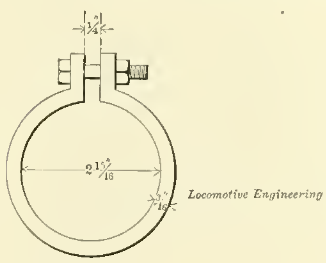


Fig. 5

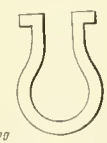


Fig. 7

screwed to the head. This is done to avoid bending the stem of the emergency piston.

When everything has been replaced, the brakes should then be tested with air to see that the triple valve and brake cylinder are all right, the train pipe is tight, the piston travel proper, and the retainer in working order. We adjust piston travel to 5 inches. If there is no air for testing purposes the piston travel is adjusted by means of the hand brake when the brake rigging is such that the hand or air brake move the levers in the same direction to apply the brakes. To do this the brake is released and a convenient point marked on the push rod when it is against the piston head. The distance this mark moves out when the hand brake is set gives the approximate piston travel.

We now use West Virginia oil, but expect soon to give a light grease a trial. I think a very light grease or a heavy oil will give best results. The last thing done is to stencil the place and date of oiling and cleaning on the auxiliary.

A reference record is kept at each cleaning point, and the cylinders and triples cleaned and oiled and the ones that each man did. A letter shows the point at which the work was done, and it is a very

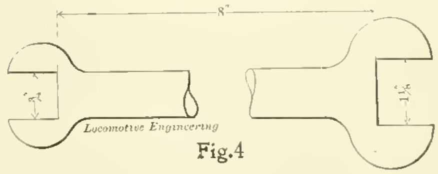


Fig. 4

easy matter to trace poor or incorrect work.

Fig. 1 is a drift used in matching holes in the dead lever guide and the hole in the dead lever.

Fig. 2 is a cotter drift.

Figs. 3 and 4 are wrenches made to fit the nuts on the triple and cylinder.

Fig. 5 is a clamp used to put on the piston sleeve to hold the release spring in compression. This is used when there is no hole through the piston sleeve for a pin.

Fig. 6 is a double-ended wrench, one end of which fits the drain cup nut and the other the nut on the cross-over connection at the triple.

Fig. 7 is a piece of ¼-inch iron, bent so that the tips can be sprung together and slipped up through the emergency valve case. With this tool the emergency piston can be easily removed if the large gasket sticks.

A Stilson wrench should also form part of the equipment. This can be used to tighten pipe joints and in renewing hose.

A hammer, chisel, monkey wrench, gaskets, stencil and stencil brush, together with a suitable box, completes the equipment.

ROBERT H. BLACKALL,
A. B. I., Delaware & Hudson Railway.
Oneonta, N. Y.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(74) C. E. G., Peoria, Ill., asks:

What will be the result of a leaky check valve in a quick-action triple when brake is set in emergency, triple otherwise being in good condition? A.—If in the emergency application, all air is released from the train pipe, and the pipe is left open,

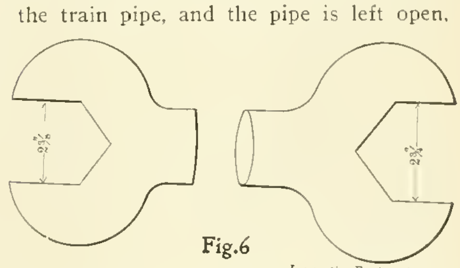


Fig. 6

the brake cylinder pressure will leak back through the leaky check valve into the train pipe and out to the atmosphere, thus letting off the brake. Should the emergency application be made and valve returned to lap, the leaky check valve will make no difference, and the brake will stay on.

(75) C. W. K., Truro, Can., writes:

With New York brake valve, I noticed once, when making station stop, that brake did not apply until valve was placed in full service notch. It worked O. K. at all other applications. What caused this? A.—When releasing brakes and recharging for the next application, the New York brake valve must be left in full release position long enough to move the equalizing piston back to normal position. If this is not done, or the release be made through the running position, the partial service notches will be useless and the brake will not apply in the first notches, but will set in the last service notch or emergency notch.

(76) J. S. C., E. Palatka, Fla., writes:

1. When my 8-inch Westinghouse air pump makes its down stroke it throws air out bottom holes of cage of receiving and discharge valve. I cannot see any defect with valves or seats. What is cause and how can I remedy? A.—1. If the blow lasts during the entire downward stroke, the receiving valve is leaking or seats improperly. If the blow is had only at the beginning of the stroke the receiving valve has too much lift. 2. What is best to take hard gum from face and seat of feed valve in feed valve attachment without injuring seats or gaskets? A.—2. Take the little valve out and soak it in kerosene oil, then scrape it off with a piece of wood or waste.

(77) J. S. C., East Palatka, Fla., writes:

1. I am running a locomotive with a D-5 engineers' valve. Air blows badly out of holes in bottom of feed valve attachment all the time. Please tell me cause and remedy? A.—1. The rubber gasket leaks. It is either ruptured or fits poorly on the piston. This gasket is the dividing partition between the train line pressure and the atmosphere; hence any leak in it would show up at the holes in the bottom of the feed valve attachment. Put in a new gasket. 2. What kind of material, sheet rubber or leather, are the two gaskets on piston of the feed valve? A.—2. The gaskets are rubber of a special manufacture, which enables them to withstand the bad effects of oil and hot air.

(78) J. S. C., E. Palatka, Fla., writes:

1. How can I get small valve in top casing of feed valve to a seat? You know bottom of this valve is soft lead and can't be ground to a seat. A.—1. Your valve is one of the earlier make, and the soft metal face must be brought to a perfect seat by scraping, and then rubbed in with a little oil. Don't rub too hard or too much, else the seat will be as bad as before work was done. 2. I can't separate train line and excess (or main reservoir) pressures on my double hand gage. How can I do it? A.—2. The little feed or supply valve leaks and permits the main reservoir pressures to mingle and equalize. Possibly the supply valve is not permitted to seat on account of the gasket between the upper and lower cases being squeezed too thin. This would raise the whole mechanism up higher than is intended and thereby not permit the seating of the supply valve.

(79) H. L. D., Jersey City, N. J., writes:

A number of our passenger cars here are equipped with inside hung brakes; that is, the brakes are hung between the wheels instead of on the outside, and we have more spotted wheels with this inside brake than with the outside hung. What is the reason? A.—The inside hung brake is undoubtedly braking higher than the outside. This is all the more probable since the inside hung brakes are of more recent design, and besides having their leverage designed to brake at 90 per cent. of the car's weight, the angle and length of the brake beam hanger is designed to give the necessary retarding effect without loss. This arrangement gives better retarding power; but if an inside hung brake car be placed in a train of ordinary cars that are not braked up to the limit, the inside braked car will do most of the work and will be the first wheels to slide.

(80) A. M. L., Harrisburg, Pa., writes:

With a freight train of forty-five cars, thirty-eight air braked, I found the brakes would set and stay stuck when I started the train. Conductor said I was trying to work too many air brakes and cut off eighteen rear brakes. Still the trouble lasted. He cut off ten more, and the trouble was as bad as ever. We then found that between the seventh and eighth cars, when the train was stretched, that the hose would pull almost straight and leak badly at the coupling. One hose was spliced and was much shorter than the other one. We changed it and the trouble disappeared. Then we cut in the other twenty-eight brakes and they worked all right. Are spliced hose allowed by the Air-Brake Association, and is this trouble common? A.—The Master Car Builders control the spliced hose question, and permit such hose to be used in the interchange of cars. The trouble mentioned has come to our attention several times before, but we can't say it is common.

(81) C. W. K., Truro, Can., writes:

In making terminal test with Westinghouse D-5 valve, if full service application is made with one reduction, train line exhau t escapes with proper rapidity; but if placed on lap after 5-pound reduction, the escape of train line exhaust is very slow for remaining 15 pounds, causing slow application of the brake. When on the road, frequently had to use emergency after 5-pound reduction had been made, when spotting cars. The same with long or short freight trains. Was the trouble with equalizing piston? A.—This trouble with the D-8 (1890 model) valve is usually caused by the packing ring in the equalizing piston fitting in the cylinder too snugly, or the piston being dry or gummy. Consequently the movement of the piston is lazy and irregular. With the D-5 (1892 model) valve, however, the same trouble will be caused by a faulty gasket leaking main reservoir pressure into chamber D. If the packing ring be reasonably tight, the pressure above the piston will be increased considerably, and several pounds must be reduced therein before the equalizing piston will rise.

(82) J. C. H., Waldo, Fla., writes:

We have an argument on here that we would like you to decide. The question is, What is the proper action for the engineer to take when a freight train breaks in two partially equipped with air; say, for example, twenty cars, the five head cars being air-braked? Suppose the engineer discovers at night that the train is parted somewhere in the air cars. A. says lap brake valve and reverse the engine; B. says lap the brake valve, leaving the throttle open; C. says lap brake valve, close the throttle, leaving the lever at full stroke ahead. The engine to be equipped with tender and driver brakes in first-class condition. It appears to me that A., in reversing his lever, would cause a dangerous shock, besides being almost sure of locking drivers. B., by leaving his throttle open, would widen a gap that would also cause a shock when closed up. C. might have a wider gap between the broken parts than A., but with both portions still in motion would not the shock be less than with either A. or B.? I hope you will give us a mechanical decision. A.—You are right. C.'s method is the proper and least dangerous one, and is the one recommended by all the best air-brake men in the country. Experience has proved that C.'s course will produce less damage than any other.

(83) C. M. S., Hagerstown, Md., writes:

I had pressure pumped up on engine, the gage registering 70 and 90 pounds. After hose was coupled to train, the equalizing piston rose, leaving air out preliminary exhaust. I could not find any apparent cause for this on engine, but found the cross-over pipe on a car broken off. After cutting out the car, the equalizing piston seated, and I had no further trouble with it. What was the trouble? A.—The only way to raise the equalizing piston in the brake valve is to either reduce the pressure on the upper side or increase it on the under side. As you didn't reduce the pressure on top of the piston, it follows that for some reason or other it was increased on the under side. This could be done in two ways: first, by the pressure in the train pipe of the car coupled onto being higher than that in the train pipe of the engine and tender; second, by having a high main reservoir pressure, which when thrown into the train pipe by placing valve handle in release position will raise the piston. The faulty car mentioned would not produce the trouble; neither would the cutting-out remedy it. While the car was being cut out, the equalizations probably took place, and made the broken cross-over pipe appear to be the source of trouble.

Thirty-Fourth Annual Convention of the Master Car Builders' Association.

The thirty-fourth annual convention of the Master Car Builders' Association was called to order at 10 A. M. June 18, in the opera house at Saratoga Springs, by President C. A. Schroyer. The Rev. Delos Jump, of the Methodist Episcopal Church of Saratoga Springs, offered prayer, after which Mr. John Foley, president of the village, welcomed the members of the convention to Saratoga Springs.

President Schroyer in his address stated that he believed the subject of basis of representation in the association, which had been called to his attention several times by representative members of large interests, should be changed from one thousand cars with eight steel trucks entitled to one vote, to the tonnage capacity, which would very materially increase the power of some of the lines from what is now represented. This proposition to place car representation on a tonnage basis is in keeping with the progress of affairs, but is seemingly too new and sudden at the present time to warrant immediate action. The subject is, however, certainly great, and would be more equitable than the system in use at present. Out of 1,348,131 cars enumerated on the 1st of January last, 1,191,189 had been equipped with automatic couplers, leaving a balance not so equipped of 156,942 cars. The report of the Interstate Commerce Commission of 1899 called attention to the fact that a very large number of cars had been found where the appliances for operating the couplers, especially the uncoupling devices, were so frequently out of order as to render the cars practically of the same kind as the old link and pin kind, and not coming under the head of cars equipped with automatic couplers, which was originally intended to remove the danger from accident to brakemen when coupling and uncoupling cars with the old type of coupler. He advised a readjustment of the rules governing the repairs and maintenance of these parts.

In conclusion, President Schroyer regretted that no progress had been made by the committee on triple valves because of failure or refusal of the New York Air-Brake Company to submit its brakes for practical or other tests. He believed that no appliance that is now added to the equipment of cars of to-day is so important as efficient air brakes, and that the tests made by the committee were highly essential and should receive the highest and promptest attention from the air-brake manufacturers. He had been approached many times during the past year by manufacturers of brake shoes who were desirous of having their devices tested by the Master Car Builders' Committee, many of which were still in an experimental stage, and which did not seem to warrant a trial by the committee. He suggested that the matter be looked after by the committee on brake shoe tests.

Secretary Taylor then read his report, in which he said that the membership of the association was now 265 active members, 190 representative members and 8 associate members, making a total of 463. The number of cars represented was 1,348,131, an increase of 8,730 over last year.

Treasurer Demarest reported as follows: Amount on hand June 4, 1899, $8,893.12; amount now on hand at this meeting, $9,836.22.

President Schroyer thought that the association should be congratulated on the condition of the treasury, especially so inasmuch that the association is at present anticipating some expenditures in experimental directions that would take a good part of the money.

Mr. Gorrell stated that his road had been following the practice of returning a number of the trucks to the manufacturers for repairs, but that it was a rather expensive operation.

Mr. Rhodes thought that the railroads should prepare themselves to do this work, inasmuch that they could doubtless do it much cheaper than the manufacturers.

Mr. Waitt stated that the practice of the New York Central was to allow unfit trucks to accumulate for a few months, and then to send the entire number to the manufacturers for repairs. This, he stated, was rather expensive, and suggested a railroad company could doubtless do better by arranging repair shops of its own. He drew attention to the fact that the car repair shops were now woodworking shops, but that, sooner or later, they would more closely resemble a boiler repair shop than at the present time.

Mr. Rhodes brought up the point to the effect that the manufacturers should bear in mind that trucks were at some time liable to need repairs, and that they should so construct them originally that subsequent repairs would be possible.

The second topical discussion of the day's proceedings was upon the question, "How soon after a new car is built should it be reweighed to modify the original stencil weight; at what intervals should it be reweighed thereafter, and what should be the minimum variation from the previous stencil weight for which change should be made?"

Mr. Delano stated that his observations had been that the shrinkage of weight of ordinary wooden cars is sometimes as great as 1,500 pounds in the first few summer months after they are built, and that if they are then reweighed the weight can be trusted for any reasonable time—say for three years, or until the car undergoes general repairs. He also stated that there was evidence that some car owners, and that practically railroad companies, were intentionally cutting rates by marking the weight of their cars from 1,000 to 2,000 pounds over the actual light weight, thus allowing a greater load to a car than the weight would show.

THE LINK SLOT IN M. C. B. COUPLER KNUCKLES.

Mr. Potter thought that the time had now arrived when the railroads would receive benefit from closing the link slot and pinhole of the knuckle and the coupler and that it was a very desirable thing to do.

Mr. Appleyard and Mr. Haskell thought that, owing to the necessary switching of cars on to boats at tidewater, the time had hardly arrived for a material change in this respect.

Mr. Rhodes brought up a similar objection on account of some roads in the West using narrow gage and broad gage cars on a three-rail track, which would necessitate the continued use of the slot in the knuckle.

There seemed to be few desires expressed for any changes in standards and recommended practice, which seemed to indicate that these were already rather satisfactory.

Mr. Rhodes said that he understood that some railroad companies were more anxious to get brake shoes introduced that would wear a long time rather than shoes that will do efficient braking. This, he thought, was inadvisable in view of the fact that high-speed trains were gradually coming into more general use than formerly, and that greater attention should therefore be paid to the holding power of brake shoes for air brakes.

The committee on air-brake appliances and specifications recommended better maintenance of freight brakes, and that bent pipe be used wherever possible instead of numerous "ells."

Mr. Pitkin Welcomes the Master Mechanics to Saratoga.

A happy innovation connected with the Master Mechanics' Convention was the inviting of Mr. A. J. Pitkin, vice-president and general manager of the Schenectady Locomotive Works, to welcome the convention to Saratoga. Among the good things which Mr. Pitkin said were:

PROUD POSITION OF THE AMERICAN LOCOMOTIVE.

When we come to think that the locomotive has to earn practically every dollar that comes into the treasury of a given road, the necessity of correct design for the service required assumes large proportions. This present gathering will doubtless, as in the past, assist each of you in catching that broader view of your responsibility as will enable you to assist the management materially in solving the problem of transporting freight and passengers under given conditions at the least possible expense. Your efforts in this direction have already been crowned with success, placing the American railroad in the proud position of being able to carry a ton of freight a given distance for far less than is done in any other country in the world, and for comfort and speed in traveling one does not need to leave home to find the best.

These facts are now recognized by many of the leading railroads abroad, and our American designs are fast finding favor where we least hoped for their adoption. One instance of this as an illustration may be of interest. In recent conversation with one of the officials of a prominent foreign railroad the remark was made that he was learning to like the American design of locomotive with its bar frame and simplicity of construction as being more durable under the severe strains of service, and the cost was very much less than his standard designs.

A HANDFUL OF COAL MOVES A CAR CONTAINING 1,000 BUSHELS OF WHEAT A MILE.

When one comes to consider that with the use of a lump of coal that you can hold in the palm of your hand, weighing 1¾ pounds, sufficient energy is created by the modern locomotive to transport a car containing 1,000 bushels of wheat a mile, the high degree of perfection of design is more nearly realized. This fact alone can well cause the Governor of our Empire State to pause and consider before approving a plan for expending the many millions on the Erie Canal, as, were the work completed, with further efforts on your part along the lines of reduced cost of movement of freight, the boatmen may find their occupation without profit. May the boatmen be spared the further humiliation and the State the expense.

Your various shops, with their many conveniences for performing the work quickly and at the least possible cost, evidence the deep thought that has been given to solving the question of reduced cost of maintenance. You must know the locomotive builder appreciates these points very keenly, and some of you will not have to go far to see some of the creatures of your own brain hard at work trying to reduce the cost of construction and produce, at the same time, a more efficient and perfect locomotive. Not only the reading and discussion of the various papers in convention will be of value, but the personal intercourse as you touch elbows on the hotel piazza or on the drive will enable you to see where you can profit by the other man's experience in meeting the difficult problems that confront you in your own especial work. In fact, I have heard many of you remark that the most valuable information you gained at the convention was obtained in this personal exchange of thought.

President McConnell's Address.

As might have been expected, the inaugural address of President McConnell before the Master Mechanics' Association contained valuable information that will be read with pleasure and profit. The principal part of the address reads:

The report of the Interstate Commerce Commission shows, on June 30, 1898, 37,234 locomotives in service. The increase in two years would indicate about 39,000 in service at the present time on 189,236 miles of railroad. Locomotive builders have been unable to handle all the work offered them in the required time. The past year has been the most remarkable in the history of this country. Manufacturing concerns of all kinds have been prosperous. Steel and iron mills have been unable to supply the demands. Railroads have shown an increase in earnings and many railroads did not own sufficient equipment to handle the increased tonnage. The advance in the cost of material used in new and repair work has been more rapid than any previous year. An average increase of 40 per cent. in ten months of 1899 shows the immense demand.

During the year 1899, 2,196 locomotives were built in the United States, costing about $25,000,000. One thousand seven hundred and sixteen were delivered to American railroads. Four hundred and eighty were shipped to foreign countries, 70 per cent. of the foreign orders being sent to Europe, Asia and Africa, 30 per cent. to Mexico, Canada, South America and the West Indies. Of the entire output of American locomotives, 21 4-10 per cent. were foreign orders. The American locomotive is making friends in all parts of the world. England and France purchased our locomotives. While England to a certain extent has adhered to their own designs, France has accepted the American locomotive with few modifications.

The year 1899 has been a year of large locomotives. Reports for the year show four types of freight locomotives having a weight of 218,000, 225,000, 230,000 and 232,000 pounds respectively, with a weight on drivers of 193,000, 198,000, 202,000 and 208,000 pounds; heating surface, 3,203 square feet, 3,322 square feet, 3,500 square feet and 4,105 square feet. One with cylinders 23 by 32 inches, two with cylinders 23 by 30 inches, and one compound with cylinders 18 and 30 by 30 inches.

Locomotive tenders were built with water capacity of 7,000 gallons. A number of roads have made 5,000-gallon tanks their standard, while others have adopted a 6,000-gallon tank. The use of cast steel in locomotive construction has increased very largely. Cast steel for frames finds many advocates in the mechanical departments of railroads as well as locomotive builders. A number of engines were constructed this year as well as last year with cast-steel frames. Steel castings have displaced cast iron to a great extent for driving wheel centers, driving boxes and cylinder heads. With the improved method of steel making and increase in number of steel foundries, a more extensive use of steel may be looked for. The difficulty of obtaining steel castings in the past has, to a certain extent, limited the amount used in the last year.

During the year 1899 a number of engines were constructed, showing an increase of 33 per cent. in the use of steel castings over three years ago.

Nickel steel has not come into very general use. Mechanical departments are advancing cautiously in this direction. It has been used to a limited extent for driving axles, crank pins and piston rods.

The use of piston valves has increased in the last year. On simple engines improved forms have been introduced, and, having passed the experimental stage, we may look to see them advance rapidly in favor.

The past year has shown the most rapid advance in weight on driving wheels, tractive power and increased heating surface of our locomotives.

The tendency is all in the direction of increased tonnage in freight trains. Large sums of money are being spent by trunk lines in cutting down grades and reducing curvature in order to reduce the cost per ton mile for handling freight. The constant tendency of a decline in freight rates can only be offset by the increased power of the locomotive. In passenger service the same development of the locomotive has taken place as with the freight engine. A few years ago 80,000 pounds weight on the driving wheels of an eight-wheel locomotive was considered excessive. It has now reached 94,000 pounds on an eight-wheel locomotive. In passenger service ten-wheel locomotives are being built with 130,000 pounds weight on the driving wheels and a heating surface of 2,500 square feet. The passenger service throughout the country has increased in the weight of trains as well as in speed.

With the large locomotives in service when compared on a mileage basis, the cost per mile for fuel, repairs and lubrication, shows an increase. Compared with several years ago, on the tonnage basis, the cost per ton mile for repairs, fuel, oil, and other supplies, is largely in favor of the recent locomotive.

The compound locomotive is gradually gaining in favor. During the year 1899 330 engines of this class were built in the United States.

The improvements during the year have not all been confined to locomotives. Shop practices have advanced to a marked degree. New shops are now largely supplied with electricity for driving machinery, and it is displacing the stationary engine and line shafting. New tools, electrically driven, are coming into general favor, and the economy of such machines cannot be questioned. Compressed air has found its way in all shops, both large and small. The air compressor is of as much value in the railroad shop to-day as the stationary engine. The manufacturers of compressed air tools have brought out new designs, and by their use the work is performed more economically. The modern shops are supplied with both electricity and compressed air. Both have their advantages and neither can displace the other on certain lines of work. For driving machinery electricity is more economical and superior to the old line shafting and stationary engine. For small tools compressed air is superior to electricity and more economical.

The Railway Mechanical Conventions.

The new arrangement of carrying through both the mechanical conventions in one week worked very satisfactorily, although there were some complaints heard, especially among supply men. The railroad men were, however, nearly all satisfied, and we heard from several of them that the new arrangement pleased the managers of railroads, as it curtailed the time that their superintendents of motive power had to be absent from their offices. In spite of the short absence necessary this year, we learned that several of the members of the Master Mechanics' Association had received telegrams urging them to return home as soon as possible. This was, no doubt, caused by the unusual activity of business, and to the fact that numerous contracts for cars and engines are under consideration.

Both conventions were unusually well attended, and valuable work was done in both of them. The Master Car Builders got through the discussion of the interchange rules with unusual expedition, which was due in a great measure to the work that had previously been done by the different railway clubs in outlining the changes that were necessary, and which became the basis of recommendations by the executive committee.

The Master Mechanics worked through a long list of subjects without the hurry that has frequently been necessary towards the finish. This was made possible by the newly adopted practice of reading the reports by abstract. This brought out the salient points of the reports and the conclusions of the committees, leaving plenty of time for discussion, which often brings out the most valuable information made known in connection with reports. The report on the progress of compound locomotives was a particularly valuable contribution to the subject, and the discussion that followed the introduction of it was one of the best we have ever listened to.

Notices were given of important changes that would be proposed on the constitution at next convention. This appears to us to be a wise move, for during the time that has elapsed since this constitution was adopted advances have occurred which render radical changes necessary. The most important advance made has been in the personnel of the members. The leaders are no longer mechanics who have risen by force of circumstances, executive ability and mechanical skill. They are educated engineers and business men, who require reports or papers to embrace special knowledge and to be the product of expert investigation. A report or paper which merely tells particulars of prevailing practice is no longer listened to with pleasure, or even patience.

There were several members new to the Master Mechanics' convention who made a decided mark as speakers, and more especially for the ability displayed in throwing new light upon a subject. The most conspicuous of these were F. A. Delano and G. W. Rhodes. Mr. Rhodes made two masterly talks—first on the pooling of locomotives, and second, on graphite as a lubricant. A pleasant feature about the meeting was that discussing the subjects was not confined to a small clique, but was participated in by many of the members. Another attractive feature was the conspicuous absence of the rambling, long-winded talker who was ever on his feet. The man who rises to object was not entirely absent; but he was less numerous than he has been at past conventions. On the whole, the thirty-third convention of the Railway Master Mechanics' Association was one of the best and most instructive we have ever attended.

Blind vs. Flanged Tires.

A question that has been frequently before the Master Mechanics' Association is the relative utility of flanged tires and blind tires for six and eight-coupled engines. It came up for discussion at the last convention by a very exhaustive report submitted by a committee of which Mr. S. Higgins was chairman. There has been decided conflict of opinion among the members concerning the advantage of using blind tires, but the tendency for the last few years has been towards flanged tires.

The conclusion of the committee's report referred to reads: "The results obtained justify the members of the committee in concluding that it is desirable to have flanged tires on all the drivers of moguls, ten-wheel and consolidation engines. With mogul and ten-wheel engines the tires should be set so that the distance between the backs of flanges will be 53¼ inches. With consolidation engines the tires on front and back pairs of wheels should be set so that the distance between backs of flanges will be 53⅛ inches; with the other two pairs of drivers the tires should be set so that the distance between backs of flanges will be 53¼ inches."

In the discussion that followed the reading of the report many speakers took part, and nearly all of them favored flanged tires. Cases were quoted where changes had been made from blind to flanged tires with great reduction of expense for repairs. A few of the members thought that all flanged tires put greater stress and wear upon the track. The tone of the discussion indicated that blind tires were falling into desuetude.

RELATIVE MERITS OF CAST IRON AND STEEL-TIRED WHEELS.

Last year a committee of the Master Mechanics' Association was appointed to investigate the "relative merits of cast iron and steel-tired wheels," and a very concise report was submitted this year, which reads:

"The only report giving data has been received from the Union Pacific Railroad, in which they state that the average cost of mileage of 33-inch cast-iron freight car wheels is 8 cents per thousand miles; the average cost of steel-tired wheels is 45 cents per thousand miles.

"Mr. G. W. Rhodes, of the Burlington & Missouri River Railroad, advises that he is of the opinion that 33-inch cast-iron wheels made to the M. C. B. standard test is a safer wheel than some of the steel-tired wheels on the market."

In the discussion that followed the reading of this report great stress was laid upon the necessity for having cast-iron wheels made under the so-called thermal test of the Master Car Builders' Association, which requires that the steel should endure sudden cooling from a temperature as high as what obtains in service under protracted use of the brake. With the general introduction of air brake this test of cast-iron wheels becomes every day of greater importance. When the M. C. B. test requirements were first adopted makers of cast-iron wheels protested that wheels could not be made to meet the severe tests, but when they found that wheels would not be purchased unless the requirements were complied with, they managed to overcome the difficulties of manufacture.

COMPOUND LOCOMOTIVES BEFORE MASTER MECHANICS' CONVENTION.

Under the comprehensive caption of "Present Status of Compound Locomotives, and What Is the Best Ratio of Cylinders for Various Classes of Locomotives in Service," a committee of the Master Mechanics' Association, of which J. F. Deems was chairman, made a very valuable report to last convention. The report was both historical, analytical and critical. The report is too long for us to publish, but we advise those interested in compound locomotives to obtain a copy of it from the secretary of the Master Mechanics' Association. The conclusions of the report read:

1. Compound locomotives have not come into general use in America, but are gradually emerging from the experimental stage.

2. Compounds have been in use in freight service longer than passenger service and there are more in such service; but in recent years there seems to be a disposition to use them also for fast, heavy

passenger service. The compound is not as well adapted to switching service as the simple engine.

3. The ton-mile system forms the basis of comparison between compound and simple locomotives. The average saving of the compound in coal consumption is 16.5 per cent.

4. The actual saving of the compound depends upon the price of coal. The greatest economy will be attained where the compound is worked continuously well up to its limit. The opportunity for saving is greater in freight service than in passenger.

5. The compound is not so flexible an engine as the simple.

6. There should be no difference in the size of drivers between the compound and simple engine in the same service.

7. The compound may be successfully pooled, if such practice is followed, with simple engines.

8. The rating for compounds should be no higher than simple engines of the same class, weight and steam pressure.

9. If it be desired to work the engine simple over maximum grades, the rating may be slightly higher for the compound than for the simple engine.

10. The correct ratio of cylinders is difficult to determine, as other factors than the determination of such ratio as will secure the minimum cylinder condensation enter into the question. In the two-cylinder type it is of paramount importance that the work in both cylinders be equalized as closely as possible for all positions of the reverse lever. This is easier accomplished if the ratio be kept down, and in freight engines it seems that a ratio of about 2⅓ to 1 would be acceptable, while for passenger a slightly higher ratio, 2.37 to 1, might be used.

For the four-cylinder compound the most important question is that of equalizing the pressure on the high and low pressure pistons, and a ratio of 3 to 1 gives good results.

11. Manual control of compounding feature is preferable to the automatic.

12. There is no necessity for having any trouble due to the use of a large cylinder if proper care be used in the design of the piston.

12½. There is less danger of starting fires from the stack of the compound than of simple engines.

13. It is necessary to relieve the cylinders while drifting, large relief valves being used on four-cylinder compounds and the by-pass on two-cylinder compounds.

14. The piston valve is preferable to the slide valve, as more perfect balance is secured, and consequently less wear of valve and seat and less strain on valve motion.

15. When comparisons have been made between compound and simple engines, the pressures were usually the same.

16. In starting it is necessary to work the engine simple; that it is bad practice to so rate the engine that it will be necessary to work it simple over heavy grades.

17. Engineers are apt to abuse the privilege of working the engine simple. With the same supplies at hand for the repairs on compound engines, there is no necessity for the compound remaining out of service for repairs any longer than the simple engines.

19. The cost of boiler repairs is less on the compound and may average 19.6 per cent. less than for the simple engine.

20. The cost of maintaining the machinery on the compound is a little more than on the simple.

21. The cost of lubrication on the compound will be about 15 per cent. more than on the simple engine.

22. The compound will be an economical machine whatever the price of fuel.

23. More compounds are in use where the fuel is expensive than where it is cheap.

23½. There is no necessity for any difference in the size of the exhaust nozzle of the compound and that of the simple.

24. Many and careful comparisons have been made of the relative performance of the compound and simple engine, and the position of the compound in railroad economy may now be determined.

25. It is possible to build a compound that will give satisfaction equal in tractive power to any of the simple engines.

26. The low-pressure piston will give better results if made of cast steel with a bronze bearing ring cast in its periphery.

27. The most notable improvements have been in the intercepting valve, in steam distribution and better design of the machinery.

28. Attention is called to the necessity of further improvement in design of machinery, intercepting valve and steam distribution.

29. With the modern machines the compound holds its place as against the simple and it is not advisable to change any in use into simple engines.

A very lively discussion followed the reading of the report, the general drift being favorable to the progress making in the perfecting of compound locomotives. The weight of testimony was that the compound locomotive is economical motion for both freight and passenger service.

Mixed Air Brakes in Long Freight Trains.

Perhaps one of the most important air-brake tests made in several years was that recently made by a representative of the permanent staff of the *Railroad Gazette* on the fifty-car rack of the American Brake Company in St. Louis. The series of tests was lengthy, and was made with a view of learning by practical experiment just how a long freight train equipped with mixed Westinghouse and New York brakes would act. The results obtained will, perhaps, prove surprising, and probably startling to many railroad men. The tests practically proved that it was unsafe to attempt an emergency application on long freight trains where both kinds of triples are mixed in, and that many erratic things were likely to happen at various other times. The New York triple was the offender each time.

The first shortcoming of the New York triple exhibited was its inability to get the 15 to 20 per cent. higher brake cylinder pressure in emergency application than in service application, as required by the M. C. B. code. This, of course, was known beforehand.

The next deficiency shown in the New York triple was its failure to jump the emergency through more than two cut-out cars. This is one of the most serious of its failures, inasmuch that the brakeman's only method of repairing a triple on the road is to cut it out.

With the Westinghouse triple quick action passed through five cut-out cars next to the tender, three in groups near the middle of the train, and ten cut-out cars just ahead of the last, or fiftieth, car. The New York could only jump two cut-out cars near the head and middle of the train. In one case quick action was had through nine cut-out cars just ahead of the last, or fiftieth, car, but when the Westinghouse triples were removed further away from the cut-out triples, leaving New York triples on both sides of the gap, the quick action would jump only through two cars. This demonstrated that the New York triple would work better in this respect when near Westinghouse triples.

Another serious shortcoming in the New York triple valve was its failure to produce an emergency application after a very light service application had been made. In the event of an emergency application being demanded after a partial service application had been made, the brake cylinder would have to wait for its pressure to come from the auxiliary reservoir through the graduating port. This unfortunate feature, in connection with no higher pressure being obtainable in emergency than in service, seriously jeopardizes train safety, and would seem to invite careful investigation by the railroads.

There will doubtless be some service tests made soon by railroads to determine the effect of mixed brakes in freight trains on the road. Much money has already been expended in equipping with air brakes, and freight train speeds have accordingly increased to those of passenger trains. Speeds will hardly be reduced to accommodate poor brake conditions, and certainly high speeds cannot be permitted if the stopping power is known to be inadequate or doubtful.

The Richmond Locomotive Works will exhibit their well-known "Tramp" locomotive, No. 2427, at the Paris Exposition, together with one of the ten-wheel engines recently built for the Finland State Railway.

Personal Department.

Mr. J. T. Ray has been appointed superintendent of the Gulf & Interstate at Galveston, Texas.

Mr. B. F. Egan has been appointed superintendent of the Great Northern at Crookston, Minn.

Mr. J. A. Droege has been appointed trainmaster on the Lehigh Valley, with office at Jersey City, N. J.

Mr. J. M. McCarthy has been appointed purchasing agent of the Florence & Cripple Creek, with office at Denver, Colo.

Mr. T. Grahn has been appointed assistant master mechanic of the Lake Shore & Michigan Southern at Norwalk, Ohio.

Mr. A. J. Davidson has been appointed general superintendent of the St. Louis & San Francisco, with office at St. Louis, Mo.

Mr. S. T. Park has been appointed master mechanic of the Santa Fe Pacific at Winslow, Ariz., vice Mr. W. S. Hancock, resigned.

Mr. E. B. Zeigler has been appointed trainmaster of the Easton & Amboy division of the Lehigh Valley; office at Easton, Pa.

Mr. Walter Hale has been appointed trainmaster of the Norfolk & Western at Crewe, Va., succeeding Mr. W. S. Becker, transferred.

Mr. W. D. Sargent, general manager of The Sargent Company, Chicago, returned from Europe last month after a two months' trip.

Mr. J. M. Thomas, general foreman of the Norfolk & Western at Portsmouth, Ohio, is appointed general foreman at Bluefield, W. Va.

Mr. T. E. Lewis is appointed general foreman of the Norfolk & Western at Portsmouth, Ohio, vice Mr. J. M. Thomas, transferred.

Mr. C. W. Welch has been appointed master mechanic of the Choctaw, Oklahoma & Gulf at Little Rock, Ark., in place of C. Robken, resigned.

Mr. W. C. Wilson has been appointed master mechanic of the Terminal Railroad Association of St. Louis, Mo., vice Mr. M. H. Smith, resigned.

Mr. H. W. Long has been appointed general foreman of the Choctaw & Memphis shops at North Little Rock, Ark., vice Mr. Frank Oliver, resigned.

Mr. C. W. Whitney, formerly on the White Pass & Yukon, has accepted the position of mechanical engineer of the Chicago, Milwaukee & St. Paul.

Mr. John R. Mitchell has been appointed general foreman of the Galena division roundhouse of the Chicago & Northwestern at Chicago, Ill.

Mr. Thomas R. Stewart has been appointed foreman of the Baltimore & Ohio roundhouse at Cumberland, Md., vice Mr. A. P. Prendergast, promoted.

Mr. J. G. Metcalfe, general manager of the Louisville & Nashville, has resigned to become general manager of the Denver & Rio Grande at Denver, Colo.

Mr. George Kauffman has been appointed trainmaster of the Mexican Central, with office at Cardenas, Mexico, succeeding Mr. Charles Stitch, resigned.

Mr. Charles A. Boies has been appointed assistant division superintendent of the Union Pacific at Laramie, Wyo., succeeding Mr. John W. Hay, resigned.

Mr. D. E. Bloxsom has been appointed master car builder of the Houston & Texas Central at Houston, Texas, succeeding James McGee, deceased.

Mr. J. Murphy, lately in charge of the air-brake repairs at Susquehanna shop on the Erie Railroad, has been promoted to gang foreman in the erecting shop.

Mr. Frederick W. Curtis has been appointed assistant superintendent of the Minnesota division of the Minneapolis, St. Paul & Sault Ste. Marie at Enderlin, N. D.

Mr. G. R. Brown, general manager of the New York & Pennsylvania at Canisteo, N. Y., has resigned his position as president of the Railway Educational Association.

Mr. J. M. Davis has been appointed general foreman of the Cleveland, Cincinnati, Chicago & St. Louis shops at Brightwood, Ind., succeeding Mr. J. M. Bruner, resigned.

Mr. A. L. Beattie has been appointed locomotive superintendent, New Zealand Government Railways, with headquarters at Wellington, N. Z., in succession to Mr. T. F. Rotheram.

Mr. B. E. Greenwood has been appointed general foreman of the Lake Shore & Michigan Southern shops at Buffalo, N. Y. He was formerly foreman of Roanoke Machine Works, Roanoke, Va.

The Westinghouse Air-Brake Company have removed their Southern office from 435 Equitable Building, Atlanta, Ga., to 2 Chamber of Commerce, Richmond, Va. Mr. Robert Burgess is in charge.

Mr. J. Burlingett, division superintendent of the Chicago Great Western at Des Moines, Iowa, has resigned to accept the position of superintendent of the St. Joseph & Grand Island at St. Joseph, Mo.

Mr. W. L. Park, assistant superintendent of the Union Pacific at North Platte, Neb., has been appointed superintendent of the Wyoming division at Cheyenne, Wyo., vice Mr. E. C. Harris, resigned.

Mr. J. E. Loy, general foreman of the Chicago, Rock Island & Pacific at Goodland, Kan., has been promoted to the position of master mechanic at Rock Island, Ill., succeeding Mr. R. D. Fidler, resigned.

Mr. C. B. Royal, division master mechanic of the Seaboard Air Line at Portsmouth, Va., has resigned to accept the position of master mechanic of the Florida Central & Peninsular at Jacksonville, Fla.

Mr. W. H. Evans, general foreman of the mechanical department of the Baltimore & Ohio at Columbus, Ohio, has been transferred to South Chicago, Ill., succeeding Mr. M. Elsner, transferred to Columbus.

Mr. J. R. Welch, formerly dispatcher at St. James, Minn., has been appointed chief train dispatcher of the St. Paul and Sioux City divisions of the Chicago, St. Paul, Minneapolis & Omaha, vice Mr. D. F. Brewer, resigned.

Mr. Charles H. Schlacks, assistant general manager of the Denver & Rio Grande, has resigned to become general manager of the Colorado Midland. This has passed to the control of the Colorado & Southern and Rio Grande Western.

Mr. F. E. Blaser, formerly trainmaster on the Western division of the Chicago, St. Paul, Minneapolis & Omaha, has been appointed purchasing agent for the Ohio River Railroad at Parkersburg, W. Va., vice Mr. M. S. Dean, resigned.

Mr. T. F. Rotheram has resigned the position of locomotive superintendent, New Zealand Government Railways, in order to take up a similar appointment on the Western Australian Government Railways, with headquarters at Perth, W. A.

Mr. E. W. Pratt, who was recently promoted from the position of air-brake inspector of the Chicago & Northwestern to be general foreman of the Galena division roundhouse at Chicago, has been appointed general foreman of the Ashland division at Ashland, Wis.

Mr. Robert H. Blackall, who for six years past has served as air-brake inspector of the Delaware & Hudson at Oneonta, N. Y., resigns that position to accept one with the Westinghouse Air-Brake Company. He will be given the Pittsburgh district, beginning July 1st.

Mr. W. B. Mallette, for nine years purchasing agent of the Chicago Terminal Transfer Railroad, has resigned to accept the position of engineer and assistant to general manager of the American Washer and Manufacturing Company, Newark, N. J., with office at 263-265 Dearborn street, Chicago, Ill.

Mr. A. Howard Stott, the representative of Postlethwaite's Sulfakilla Company, sailed for England on June 30. Mr. Stott has enjoyed his four months' stay in this country, due to the cordial treatment he has received from those interested in a car cleaner and by many others. He expects to renew the acquaintance next October.

The following changes have been made on the Union Pacific: Mr. C. B. Keyes, acting assistant superintendent at Omaha, has been transferred to North Platte, Neb., in place of Mr. W. L. Park, promoted. Mr. Charles Ware, chief train dispatcher at Omaha, has been appointed assistant superintendent at Omaha, in place of Mr. Keyes.

That portion of the Easton & Amboy east of Parkview, N. J., the Perth Amboy branch, the Perth Amboy & Raritan Railway, and the Tidewater floating equipment, will constitute the New York division of the Lehigh Valley. Mr. W. O. Sprigg is appointed superintendent, with office at Havemeyer Building, 26 Cortlandt street, New York.

H. Walter Webb, who resigned the vice-presidency of the New York Central a few years ago on account of ill health, died last month. Had his health been spared him, Mr. Webb would, in the natural course of things, have come into the presidency of the New York Central. Mr. Webb was born at Tarrytown, N. Y., May 6, 1852. He entered railway service in 1886.

Mr. Ben Johnson, who was lately a master mechanic on the Atchison, Topeka & Santa Fe at Topeka, has been appointed engineer of tests for that company. Mr. Johnson is a graduate of Cornell, who has come up through the locomotive department of the Santa Fe. He was for some years an inspector for the Westinghouse Air-Brake Company, but returned to railroad service in 1898.

That portion of the Easton & Amboy Railroad comprising the main line and branches west of Parkview, N. J., except the Perth Amboy branch and the Perth Amboy & Raritan Railway, will constitute the New Jersey division of the Lehigh Valley. Mr. George M. Harleman is appointed superintendent of the Lehigh and New Jersey divisions, with office at Easton, Pa., vice Mr. W. O. Sprigg, transferred.

Mr. J. S. Pearce, formerly division master mechanic of the Western general division of the Norfolk & Western, is appointed division master mechanic, with headquarters at Roanoke, Va., with jurisdiction from Norfolk to Bristol, including all branches and Roanoke shop, vice Mr. J. E. Battye, deceased. The foremen and general foremen at outlying points from Norfolk to Bristol, including all branches, and the general foremen at Roanoke shop will report to and receive instructions from the division master mechanic at Roanoke.

Mr. L. P. Ligon, formerly general foreman of the Norfolk & Western, at Bluefield, W. Va., is appointed division master mechanic, with headquarters at Bluefield, W. Va., with jurisdiction from East Radford to Columbus, including all branches, vice Mr. J. S. Pearce, transferred. Mr. Ligon proved himself a highly efficient general foreman and thereby earned the deserved promotion which has come to him. He has a very happy manner in handling men, and is highly popular with those under him, although he is a good deal of a hustler.

The following changes have been made on the Atchison, Topeka & Santa Fe: Mr. B. Johnson, master mechanic of the Eastern division at Topeka, Kan., has been appointed engineer of tests, and Mr. Thomas Paxton, master mechanic at Fort Madison, Iowa, has been transferred to Topeka to succeed Mr. Johnson. Mr. John Purcell, foreman of the shops at Argentine, Kan., has been appointed master mechanic of the Chicago division at Fort Madison, Iowa. Mr. A. Mitchell, master mechanic of the Southern Kansas division at Ottawa, Kan., has had his jurisdiction extended over the Panhandle division, with headquarters at Chanute, Kan.

Mr. Julius S. Jansen, who has been mechanical engineer of the New York, New Haven & Hartford Railroad for the past ten years, sailed June 14th, on the steamer "Columbia," to accept the position of superintendent of the Borsig Locomotive Works, Tagelbei Bertin, Germany. Just before leaving New Haven he was given a banquet by his many friends and presented with a fine gold watch and chain as a token of esteem. A very able presentation speech was made by Master Mechanic Hocking. Mr. Jansen replied appropriately, after recovering from his surprise. Mr. Jansen is a thorough engineer, having been educated in Copenhagen, and with several years' experience as machinist, fireman and engineer. He leaves a host of friends, all of whom wish him well in his new position.

Mr. W. R. Scott, who was lately promoted from trainmaster to superintendent of the Northern division of the Gulf, Colorado & Santa Fe Railroad, with headquarters at Cleburne, Texas, has come up through the locomotive department. He began work for the Santa Fe route early in the eighties, while yet a boy, as a fireman. He was promoted to engineer in 1884. In 1891 Mr. Player appointed him traveling engineer, with jurisdiction from Chicago to El Paso, Texas. This position he filled with credit till August 15, 1898, when he went into the transportation department as trainmaster on the Gulf, Colorado & Santa Fe. On June 1, 1900, he was promoted to his present position as superintendent of the Northern division. We notice a good many appointments in the transportation department are made from those men who have a thorough knowledge of train service gained by experience while on a locomotive.

The following officers were elected by the Master Car Builders' Association at the Saratoga convention: President, J. T. Chambertain; first vice-president, J. J. Hennessey; second vice-president, J. W. Marden; third vice-president, F. W. Brazier. Executive committee: E. D. Bronner, J. H. McConnell, William Apps.

The following officers were elected by the Master Mechanics' Association at the Saratoga convention: President, W. S. Morris; first vice-president, A. M. Waitt; second vice-president, J. M. Barr; third vice-president, George W. West; treasurer, Angus Sinclair; secretary, J. W. Taylor. The secretary was elected by the executive committee, which is composed of the president, vice-presidents and treasurer.

Our president, Angus Sinclair, leaves for Europe July 4th, on the White Star steamer "Majestic." His real object in going abroad is to keep an agreement made with his mother twelve years ago, that he would visit her every two years as long as she lives. She is now nearly eighty-nine years old, but is still in possession of all her faculties, and is reputed by the family to faithfully read LOCOMOTIVE ENGINEERING every month from beginning to end, including the advertisements. Mr. Sinclair expects to spend some time at Paris, and a brief visit will be made to Switzerland. He holds a commission from the United States Government to investigate European railways, which was given in connection with an article on "The Development of American Locomotives," which he wrote lately for the United States Government Year Book. Besides visiting most of the locomotive superintendents in the British Isles, Mr. Sinclair expects to spend a few days with his friend, Mr. Andrew Carnegie, at Skibo Castle.

Falls Hollow staybolts have been specified on locomotives now being built by Rogers, Richmond and Rhode Island Locomotive Works. The engines are for the Texas & Pacific, Mobile & Ohio, International & Great Northern, Brainard & Northern Minnesota and Plant System.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, and also president of the New York Air Compressor Company, who has just returned from Europe, brought with him an order for twelve air compressors for European shipment. The New York Air Compressor Company has also received an order for one of their compressors to be shipped to Yokohama, Japan.

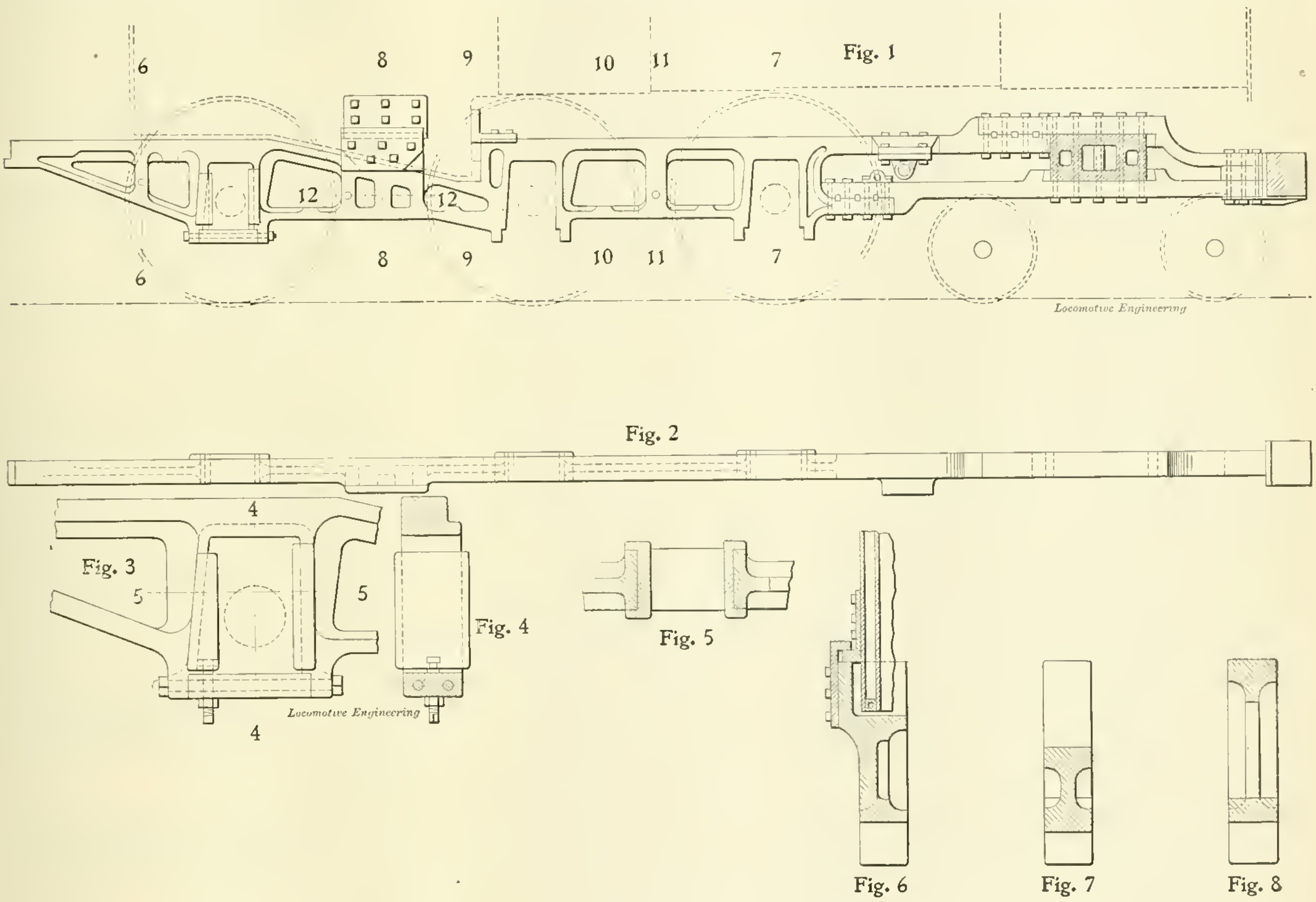
A New Locomotive Frame.

The use of cast steel for locomotive frames has led to considerable speculation as to the best form to give the metal, and many still adhere to the old square-bar section. They argue that the greatest strains are due to the working of the engine. In other words, the compression and tensile strains are of much more importance than the "beam action," or those due to supporting the load. For a beam there is no questioning the advantage of the I-section, but, granting the former views are true, it is a question of cross section, and the square or rectangular section is the most compact.

Taking the other side, and we find a form of frame recently patented by Mr. R. M. Galbraith, of Pine Bluff, Ark., details being shown in the accompanying cut. As will be seen, a T-section is used top and bottom, which might possibly be called an I-section with open center. The jaws are widened to give a large bearing to the shoes and wedges, which is, of course, a good feature. The same could, of course, be done in any cast frame, regardless of general form. The expense of forging, however, practically bars it in a wrought frame.

It will also be noted the ease with which expansion pads can be attached in Fig. 6, but, as before, this can be done in any cast frame. Figs. 5, 7 and 8 give further details of the shape.

Mr. Galbraith writes that the frame has been applied to eleven locomotives with 20 x 26-inch cylinders, and has been giving good service. He anticipates that it will increase the life of shoes and wedges 100 per cent. He also states that the weight is 33 per cent. less and the strength 66 per cent. more than a square wrought-iron frame. This is evidently based on its work as a beam, and not the pull of cylinders.



GALBRAITH'S CAST STEEL FRAME AND DETAILS.

An order has just been promulgated by the Chicago, Burlington & Quincy, doing away with the ringing of engine bells at street crossings along the elevated portions of the line from Western avenue, in Chicago, to the city limits. This is the initial step in decreasing the noise nuisance caused by railroads, and the example will probably be followed by other roads. Cause for the action is found in the recent crusade against unnecessary noises and in the complaints of patrons and residents along the line. A city ordinance requires the ringing of engine bells eighty rods from the place where the railway crosses or intersects a public highway. The Chicago, Burlington & Quincy's law department has ruled that there can be no intersection or crossing where tracks are elevated.

The United States Metallic Packing Company have issued an instruction card for the use of those who look after packing repairs in the roundhouse and repair shops. The suggestions given are the result of years of experience, and should materially assist in securing results satisfactory to both user and maker. The cards are neatly printed and are varnished, so as to allow of their being kept clean in any shop. The company's address is 427 North Thirteenth street, Philadelphia, Pa., and we advise sending for one of their cards.

On the great plains east-bound passenger trains from Denver descending the steady down grades between Denver and Hastings, Neb., cannot make time against adverse winds, while west-bound trains easily surmount the grades, aided by the diminished atmospheric resistance. In its contract with railroad companies the Post Office department officially recognizes the retarding effect of head winds. The railroad companies forfeit certain amounts of money whenever their mail trains are behind time. They are, however, allowed a rebate if it can be shown by the United States Signal Service reports that the delayed mail train in question faced an adverse wind equalling or exceeding a velocity of 20 miles an hour.

The Largest Locomotive in the World.

The supplement which accompanies this issue of LOCOMOTIVE ENGINEERING shows the largest locomotive yet built, and every railroad man will note that in spite of its great size the design is pleasing and the engine does not appear ungainly or to have had dead weight added simply for the sake of weight. As a matter of comparison with other large engines, the builders send us the following table, which is interesting. The main dimensions follow, and it will be noted that the engine is not a mastodon, but a consolidation, making the immense weight all the more remarkable:

Railroad	P. B. & L. E.	Union R. R.	Illinois Central.	Lehigh Valley.
Builder	Pittsburgh.	Pittsburgh.	Brooks.	Baldwin.
Size of Cylinders	24 x 32″	23 x 32″	23 x 30″	18 & 30 x 30
Total Weight	250,300 lbs.	230,000 lbs.	232,200 lbs.	225,082 lbs.
Weight on Drivers	225,200 "	208,000 "	193,200 "	202,232 "
Total Weight of Engine & Tender	391,400 "	334,000 "	364,900 "	346,000 "
Tractive Power based on 25% of Adhesive Weight	56,300 "	52,000 "	48,300 "	50,558 "
Net Hauling Capacity on Level	7847 tons.	7261 tons.	6717 tons.	7049 tons.

GENERAL DIMENSIONS.

Weight on drivers—225,200 pounds.

Weight on truck wheels—25,100 pounds.

Total weight—250,300 pounds.

Weight of tender, loaded—141,100 pounds.

Total weight of engine and tender—391,400 pounds.

Total wheel base of engine—24 feet 4 inches.

Driving wheel base—15 feet 7 inches.

Total wheel base of engine and tender—57 feet 11¾ inches.

Engine length over all—41 feet 1½ inches.

Total length over all of engine and tender—68 feet.

Height, center of boiler above rails—9 feet 8 inches.

Height of stack above rails—16 feet.

Firebox heating surface—241 square feet.

Heating surface, tubes—3,564 square feet.

Total heating surface—3,805 square feet.

Grate area—36.8 square feet.

WHEELS AND JOURNALS.

Number of drivers—8.

Diameter of drivers—54 inches.

Material of drivers—front, intermediate and back, centers, steeled cast iron; main centers, cast steel.

Diameter of truck wheels—30 inches.

Driving journals—front, intermediate and back, 9 x 13 inches.

Main driving journals—10 x 13 inches.

Engine truck journals—6 x 12 inches.

Main crank pin—7½ x 8 inches.

CYLINDERS.

Cylinders, diameter—24 inches.

Pistons, stroke—32 inches.

Piston rods, diameter—4½ inches.

Main rod length, center to center—118⅝ inches.

Steam ports, length—20 inches.

Steam ports, width—1⅝ inches.

Exhaust ports, length—20 inches.

Exhaust ports, width—2¼ inches.

Bridge, width—1½ inches.

VALVES.

Valves—balanced.

Greatest travel—6 inches.

Outside lap—1 inch.

Inside lap or clearance—none.

Lead in full gear—1-10 inch.

BOILER.

Type—straight, with sloping back end.

Water test—330 pounds.

Steam test—240 pounds.

Working pressure—220 pounds.

Thickness of material in barrel—1 inch.

Diameter of barrel at front sheet—84 inches.

Diameter of barrel at throat sheet—88 inches.

Diameter of barrel at back head—81½ inches.

Kind of seams—horizontal, butt joint, double welted, sextuple riveted; circumferential, double riveted.

Thickness of tube sheet—⅝ inch.

Dome, diameter—32 inches.

Safety valves—two 3-inch open pops and one muffler.

Water supplied by two No. 12 injectors.

Crown sheet supported by radial stays.

TUBES.

Solid drawn steel.

Number—406.

Outside diameter—2¼ inches.

Length over tube sheets—15 feet.

FIREBOX.

Length—132 inches.

Width—40¼ inches.

Depth at front end—82⅞ inches.

Depth at back end—70⅞ inches.

Thickness of crown sheets—7-16 inch.

Thickness of sheets, sides and back—⅜ inch.

Thickness of tube sheets—½ inch.

Water space width—front, 4 inches; back, 4 inches; sides, 4 inches.

Grates—cast iron, rocking pattern.

SMOKEBOX.

Diameter of smokebox—85¼ inches.

Smokebox, length from tube sheet to end—68⅝ inches.

Exhaust nozzle—single.

Exhaust nozzle, diameter—5¾ inches.

Smokestack, least diameter—17 inches.

Smokestack, greatest diameter—18 inches.

Smokestack, height above smokebox—33 inches.

TENDER.

Tank capacity—7,500 gallons of water, 14 tons of coal.

Type of under frame—steel channels.

Diameter of truck wheels—33 inches.

Diameter and length of axle journal—5½ x 10 inches.

Length of frame over bumpers—25 feet.

Length of tank—23 feet 6½ inches.

Width of tank—9 feet 10½ inches.

Height of tank, including collar—81 inches.

M. C. B. coupler and Westinghouse friction draft gear.

New Cars for the Black Diamond Express.

The Lehigh Valley road have just received six new coaches for the Black Diamond Express from the Pullman Company, which are probably the finest in the country. The illustration shows the interior of one of them, and the richness of the furnishing is apparent.

Each car has a large smoking room for men and a luxurious retiring room for the ladies, in addition to the usual saloons for each. They seat sixty-nine people, weigh 50 tons, are 70 feet long and a trifle over 10 feet wide. The roof is what is called the Empire style of construction and is made of three-ply whitewood.

The cars have hot water heaters, Pintsch lights, Gould couplers and Westinghouse high-speed brakes, with a power equal to 90 per cent. of weight of car.

NEW CARS FOR BLACK DIAMOND EXPRESS—LEHIGH VALLEY RAILROAD.

Mr. Geo. H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, is sending out copies of a new issue of "A Message to Garcia." This is the "Second Half-Million Edition," and the salient points of the message have been beautifully illustrated. It also contains a sketch of the life of Lieut.-Col. Rowan, with a portrait; also a portrait and sketch of General Calixto Garcia and a portrait of Elbert Hubbard, the man who wrote "A Message to Garcia," and a short sketch of his life. A copy will be mailed free, postpaid, to any country on the globe on receipt of a 1-cent stamp.

"Machine Tools" is the name of a very artistically designed illustrated catalogue issued by the Pond Machine Tool Company, of 136 Liberty street, New York, describing the tools shown by the company at the Paris Exposition. The descriptions are in English, German and French. The tools illustrated and described are engine lathes, planing machines, radial drills, boring and turning mills, and machinery for wheels and axles. Besides its intrinsic merit as an illustrated catalogue, the work will be useful to many people on account of its giving the French and German names for the tools and their parts.

"The Application of Mechanical Draft to Stationary Boilers" is the latest contribution of Walter B. Snow to this important subject. It is a paper read by Mr. Snow before the New England Cotton Manufacturers' Association, and, as usual, is full of practical information for all boiler users. A copy can be had by applying to B. F. Sturtevant Company, Boston, Mass.

One would hardly imagine that there were over 12,000 valve stem and rod packings used in a year. Yet the United States Metallic Packing Company put out 12,365 packings in 1899. They have issued a little booklet showing where they went and the names of the largest concerns in the country are in the list.

The Rue Manufacturing Company, 215 Rose street, Philadelphia, Pa., have favored us with a copy of the new Railway Edition of their Injector Catalogue for 1900. It illustrates their well-known "Little Giant" injector, and gives details. Their boiler washer and tester is also shown, together with a long list of parties using it. It is the best method for washing and testing boilers we know of.

The Crosby Steam Gage and Valve Company, Boston, Mass., have favored us with a copy of their latest catalogue. This shows their whole line of goods, including the well-known Crosby indicators, steam gages, chime whistles, pop valves, counters, air-brake recorders and other devices. As usual, it is nicely printed and bound, and the information contained is of value to anyone connected with steam engineering in any capacity.

Bethlehem Steel Company have issued a neat catalogue showing works in Cuba, storage yard, blast furnaces, casting pigs, open hearth furnaces, steel ingots by fluid compression, furnaces, hammers, etc. It is an interesting little book, and gives one a good idea of the work of a modern steel plant. We presume one of these can be obtained from any of their offices, one of which can be found in most cities.

"Wonderland, 1900," surpasses all former editions; but we are so used to that, it is hardly a surprise. These publications have gained a splendid reputation for artistic effect as well as for valuable information, and the fact that they can go on year after year, giving new views and data, shows the almost inexhaustible variety of scenery of this section. Mr. Fee, the general passenger agent of the Northern Pacific, is to be congratulated once more on his success. "The Story of a Railway," "Through Yellowstone Park," "Tales of Two Wayside Inns" and "On the Trail of Lewis and Clark" are all very interesting bits of literature. A copy will be mailed for six cents in stamps.

"Summer Tours and Fares to Mountain, Lake and Ocean Resorts" is a dainty book just issued by the Lehigh Valley road. The cover is a beautiful piece of color work. Its sixty-two pages are full of illustrations and information of interest to those who leave their homes for a short vacation. A copy can be had by sending ten cents in stamps to Chas. S. Lee, general passenger agent, 26 Cortlandt street, New York.

About three years ago the Standard steel platform for passenger cars, designed by H. H. Sessions, was placed upon the market by the Standard Coupler Company. It is now in use on eighty railroads, besides being the adopted standard of the Pullman Company. The president of the Standard Coupler Company, Geo. A. Post, makes the interesting statement that, during the first three months of 1900, shipments of steel platforms have been made for application to equipment of railroads that, in the aggregate, operate in every State and territory of the United States, except Delaware, and as well in Canada and Mexico.

The contract for all of the electric heaters to be used on the Boston Elevated Railway has just been awarded to the Gold Car Heating Company, of New York city. This is one of the largest orders for electric heaters that has ever been placed, and includes, in addition to the elevated equipment, an order for 150 sets of street car heaters. The elevated cars are to be fitted up with the Gold standard electric heaters and the street cars will be equipped with the Gold panel electric heaters. Before awarding this contract the Boston Elevated Railway officials made very extensive tests of electric heaters furnished by five different heating companies, so that their decision in favor of the Gold heater means a great deal for the Gold Car Heating Company.

The Consolidated Railway Electric Lighting and Equipment Company, of New York, had a very interesting exhibit at the mechanical conventions, of their electric axle light. This was supplemented one evening by a run with the car "Louisville," belonging to Mr. August Belmont, which is fully equipped with incandescent lamps and electric fans which are operated by a current supplied by the company's system of axle generation. A trip of about 30 miles was made on the Delaware & Hudson Railroad. The speed varied from 20 to 45 miles an hour, and the lights displayed no change of intensity at the varied speeds. A large company of railroad men were in the car during the run, and most of them expressed themselves as being highly satisfied with what they had seen.

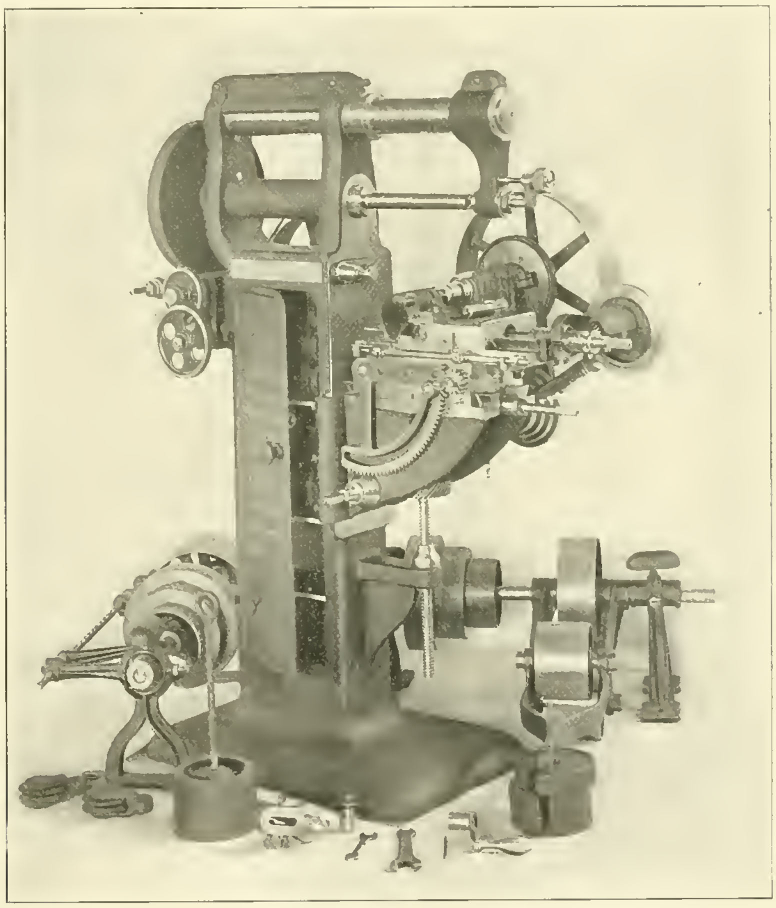
An important increase of pay was recently granted to the engineers and firemen of the Baltimore & Ohio.

Brainard Automatic Gear Cutter.

The main feature of this machine is its extreme accuracy. The dividing wheel is made in two parts, is actuated by a steel worm, and has its final adjustment made under a microscope. Compensating devices are provided for maintaining this accuracy.

Numerous original devices are provided which assist the operator in doing work rapidly and easily. A centering device fixes the exact center of cutter without reference to position of knee or other parts. The cutter can be set to exact depth without a gauge by reading micrometer dial on elevating screw, and there are other equally convenient features.

The feed is automatic, feed belt running in one direction at all times, yet feeding both ways and giving a return speed of about forty to one. There being no reversal of driving parts, there is no shock, and the whole movement is smooth and almost noiseless.



BRAINARD AUTOMATIC GEAR CUTTER.

The machine shown cuts up to 18-inch spur, bevel and worm gears, and weighs about 1,600 pounds. As its name indicates, it is automatic in all its movements, but can, of course, be operated by hand at any time if desired.

Further particulars and catalogues can be had of the makers, the Becker-Brainard Milling Machine Company, Hyde Park, Mass.

The Ajax Metal Company, Philadelphia, write us: "Not in the history of our company have we been as busy as we are at the present time. In our foundry we are running double force, and then are behind with our orders. We are receiving daily large orders for our celebrated Ajax Plastic Bronze. This metal seems to be the popular thing, and it is becoming fashionable for all railroad officials to correspond with us, and there is scarcely a day that we do not receive inquiry relative to same.

Railway Souvenir.

We have received from the Colliery Engineer Company, Scranton, Pa., a copy of the railway souvenir of the International Correspondence Schools. It is very artistically got up, and contains valuable information about air brakes and other railway mechanism, illustrated by colored charts. It describes the origin and growth of the schools, the building, methods of instruction and business organization; but the part that is of most interest to railroad men is the description of the railway department, with pictures of the men connected with it. There are also views of the offices, where the instruction is carried on. Copies will be sent to any address on application to W. N. Mitchell, manager of the railway department, 1005 Manhattan Building, Chicago, Ill.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(59) F. A., Maryborough, Queensland: Your question regarding the injector has been answered direct by the maker.

(60) G. J., Converse, Ind., says:

I am using a Sellers 1876 injector that will not force water unless I leave squirt hose open; no air leaks that I can find; injector O. K. A.—The opening between the injector and the boiler is probably stopped up so the water cannot get away from the injector as fast as it comes through the delivery tube. Opening the squirt hose will give another opening for the water to escape and the injector will not break.

(61) G. M., Myersdale, Pa., asks:

1. What is a "right lead" engine? A.—1. One in which the right crank pin leads the left. With right-hand crank pin on forward center, the left pin will be at top quarter if the right side leads, and at bottom if left side leads. 2. What use are vacuum valves on steam chests? A.—2. Vacuum valves are check valves which open inward and allow air to flow into steam chest when an engine is drifting. This is to prevent the vacuum naturally formed in chest from drawing down cinders and ashes and cutting valve seats.

(62) C. M. F., Chicago, Ill., says:

One of our branch engines has hot engine trucks every time the cellars are repacked. The journals run cool going out on the run, but coming back they get hot in a few miles. Why is this? A.—When the cellars are freshly packed, if the waste can roll up towards the back of the journal going out it does so. When you start to back up this waste will roll the other way, and wedge in so tight it gets hot instantly. Put the waste in the cellar so that it will not get loose and wedge up behind the journal. This will cure the trouble.

(63) S. B. C., Brandon, Manitoba, wants to know:

In comparing the sizes of different journals on an engine how will we calculate the surface of the journal to get the number of pounds load per square inch? A.—Multiply the length of the journal by its diameter, both dimensions being in inches. The product will be the entire surface which you can use for this measurement. If the brass bearing is, as is usual, shorter than the journal and is so narrow as to cover less than one-third of its circumference, the actual bearing surface of the brass on the journal should be used.

(64) E. M. J., Rochester, N. Y., asks:

We hear a good deal about the steam condensing in the cylinders of a locomotive and losing its power. Is this on account of the exposed condition of the cylinders or because of the expansion of the steam? A.—Both of the above causes operate to condense the steam. The losses from cylinder condensation due to their exposure to a draft of cold air when running are very heavy. Much of this can be saved by proper lagging with some non-conducting material, with dead air spaces to prevent radiation of heat. The losses due to expansion cannot so easily be taken care of.

(65) C. A. M., Baltimore, Md., writes:

Is there much difference in the deflection of a bridge when a train is running fast over it from what there is when the same train stops on it? I hold that the greatest deflection is under the steady load, but friends take the opposite view, and we have decided to leave the decision with you. A.—The greatest deflection is under the moving, or what engineers call the dynamic load. The train at rest upon the bridge is said to put on a static load. With well-made bridges that have a good margin of safety, the difference of deflection due to the dynamic and static loads is very slight.

(66) G. J., Converse, Ind., says:

We have an old class C. P. R. R. engine, with a safety valve that has a muffler bolted on one side (a sketch is enclosed). How will I set the safety valve so the muffler will blow off first? Now both blow off together any place you screw it down to. A.—This type of muffler is so old that very likely some of the original parts have been changed in the one you have. As we understand it, there are two openings for the steam to pass out of when the valve raises, one through the valve and one through the muffler. These openings may be regulated in the valve so the steam blowing past the seat of valve will all go through the muffler at first, and later on some of it be discharged through the valve.

(67) L. W. K., Truro, Canada, asks:

In using the Leach sander we find wet sand in the bottom of the large pipes coming from the back sander, so they have to be cleaned out frequently. The sand used comes from the seashore and is perfectly dried. No water is allowed to collect in the main reservoir. What is likely to be the cause of this trouble? A.—When the wet sand lodges in the end of sand pipes next to the rail it is because the water gets up in the pipe and wets the sand when it comes down. The back sand pipe will get more water in it as the tire throws water up in there. If the sand gets wet up in the case where the air blast strikes it, very likely the air valve leaks a little and allows a small quantity of air to pass steadily into the sander. As all the vapor in the compressed air may not be condensed and precipitate in the reservoir, the sand will get damp.

(68) B. D., Toledo, Ohio, writes:

Will you kindly explain what is meant by the terms tractive coefficient and horizontal effort, and how to reduce the latter to horse-power? A.—Tractive coefficient is the ratio of the tractive power to the weight on drivers. With the weight on drivers 40,000 pounds and the tractive power 10,000 pounds, divide 10,000 by 40,000 and get .25 as the tractive coefficient. Horizontal effort is drawbar pull or tractive power. Reducing tractive power to horse-power is as follows: Assuming a pull of 10,000 pounds at 10 miles per hour, we have $10 \times 5,280 = 52,800$ feet per hour, or 880 feet per minute. $10,000 \times 880 = 8,800,000$ foot pounds. Dividing by 33,000 foot pounds (1 horse-power), we have 266.6 horse-power developed at drawbar. A shorter rule is to multiply speed in miles per hour by the tractive power in pounds and divide by 375. This gives the same result, but the former shows how this is done.

(69) R. G. M., Wilkesbarre, Pa., writes:

1. If you want to change the valve motion of an engine to make one side cut off 1 inch earlier than the other side, how much must you shorten the hanger? A.—1. That question cannot be answered intelligently without studying an outline of the valve motion. 2. Does the amount of outside lap increase the speed of an engine?. A.—2. Under proper limits it does. 3. What is the best way to test a valve strip for a blow? A.—3. Put valve on middle of seat and admit steam and listen for the blow. We are a little tired of answering this question, and recommend our readers to look over our back numbers. 4. How much clearance should a link have and what is the slip of link block generally allowed on American engines? A.—4. The clearance must be sufficient to prevent the block from striking the end of the link. The amount of slip depends on how the link is designed. You had better get Halsey's book on "Locomotive Link Motion" and study it.

(70) H K., Jersey City, says:

Some of us have had an argument as to what controlled the movement of the valves. A says that it is the link block; B that it is the radius of the link; C that it is the angularity of the eccentric rod. A says there is no such thing as the angularity of the eccentric rod. Now, who is right? A.—The movement of the valve is produced primarily by the eccentric cam. This movement is communicated to the valve through the medium of the eccentric strap, the eccentric rod, the link, the link block, the rocker arm, the valve rod and valve yoke. The eccentric cam, its strap and rod and the ends of the link, where the rods are coupled, have a certain movement at all times. By shifting the position of the link block in the link the movement of the valve can be changed, or, you might say, controlled, so it will have either part or all of its full travel. The position of the link hanger connection on the link will also affect the movement of the valve. The angle of the eccentric rod affects the movement of the valve considerably for the same reason that the angularity of the main rod affects the movement of the crosshead. Get a copy of Halsey's book on "The Locomotive Link Motion." It will explain all this to you.

The Pedrick & Ayer Company have just issued a new catalogue of 126 pages, illustrating the standard and special railroad appliances which they have made for many years. Their compound locomotive cylinder boring bars and special Corliss valve seat boring bars are new, and there is also a radical departure from former catalogues in a very complete line of pneumatic hoists, vertical and horizontal, with necessary appliances, as well as jib and traveling cranes. Especial attention is given to the improved pneumatic riveting machines which they build. They are now prepared to furnish these of any special design of frame, from portable machines for light work up to the heaviest stationary riveters for large boiler work. There is a decided change in the ratings of the company's machines, giving the total effective pressure exerted on a rivet, with various sizes of standard frames, ranging from 43,000 pounds to 188,000 pounds exerted pressure on the rivet; also the length of the final effective stroke which carries this maximum pressure. In arriving at the effective pressure desirable for a given sized rivet they state that it is the practice of the best concerns to make a distinction of 20 per cent. less pressure on rivets for structural work than for steam-tight work. Copies of the catalogue, we are informed, may be obtained free upon application at the sole selling offices of the company, 85, 87, 89 Liberty street, New York.

CONTENTS.

INDEX TO ADVERTISEMENTS.

Locomotive Engineering

Copyright, 1900.

A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII — 95 Liberty Street, New York, August, 1900 — No. 8

A Schenectady "Atlantic" Type Engine.

This is one of the latest heavy passenger engines for the Chicago & Northwestern road, and, as will be seen, has a firebox extending over the trailing wheels having a width of 65¼ inches. It has piston valves, bushed cylinders, and uses hemp packing on valve stem. This is out of the ordinary practice for 200 pounds of steam, and will doubtless be closely watched by our metallic-packing friends. It has Westinghouse-American combined brakes, Westinghouse 9½-inch pump, magnesia sectional lining, Leach sanders, Golmar bell-ringer, Jerome metallic packing on piston rods, Monitor injectors, and a "Vogt" throttle. The main dimensions follow:

Weight in working order—160,000 pounds.

Weight on drivers—90,000 pounds.

Wheel-base—Driving, 7 feet; rigid, 16 feet; total, 26 feet 9 inches.

Cylinders—20 x 26 inches.

Greatest travel of slide valves—6 inches.

Outside lap of slide valves—1¼ inches.

Inside lap of slide valves—⅛ inch, front and back.

Lead of valves in full gear—None, line and line.

Diameter of driving wheels—80 inches.

Trailers—48 inches.

Diameter and length of driving journals—9 inches diameter by 12 inches.

Diameter and length of main crank pin journals (side, 6¾ x 4½ inches)—6 inches diameter by 6 inches long.

Diameter and length of side rod crank pin journals—4½ inches diameter by 4 inches.

Engine truck journals—6 inches diameter by 10 inches.

Boiler, outside diameter of first ring—68⅜ inches.

Working pressure—200 pounds.

Firebox, length—102⅛ inches.

Firebox, width—65¼ inches.

Tubes—Number, 338; diameter, 2 inches; length over tube sheets, 16 feet.

Heating surface—Tubes, 2816.91 square feet; water tubes, 28.27 square feet; firebox, 170.7 square feet; total, 3,015.88 square feet.

Grate surface—46.2 square feet.

Exhaust pipes—Single.

Exhaust nozzles—4¾, 5, 5¼ inches diameter.

Tender, weight, empty—43,200 pounds.

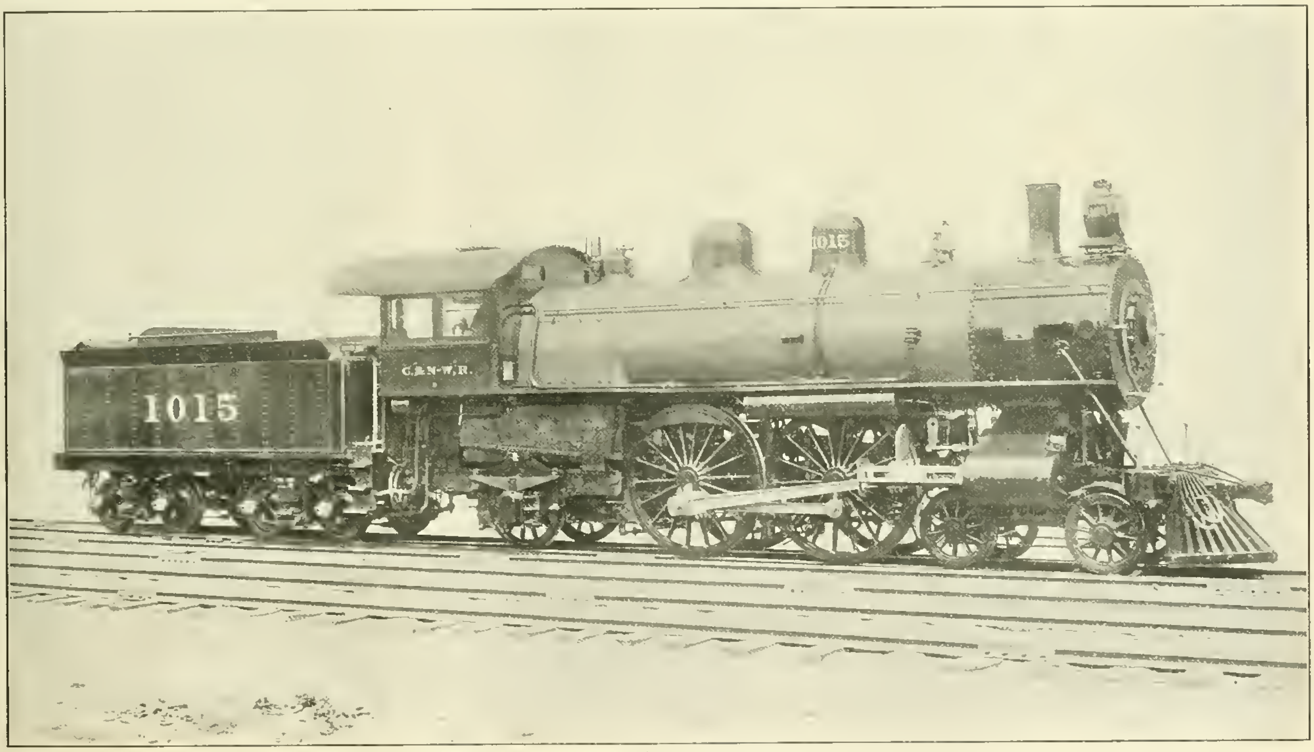
Journals, diameter and length—5 inches diameter by 9 inches.

Wheel-base—16 feet 10 inches.

Water capacity—5,200 United States gallons.

Coal capacity—8 tons.

Total wheel-base of engine and tender—54 feet 8¾ inches.



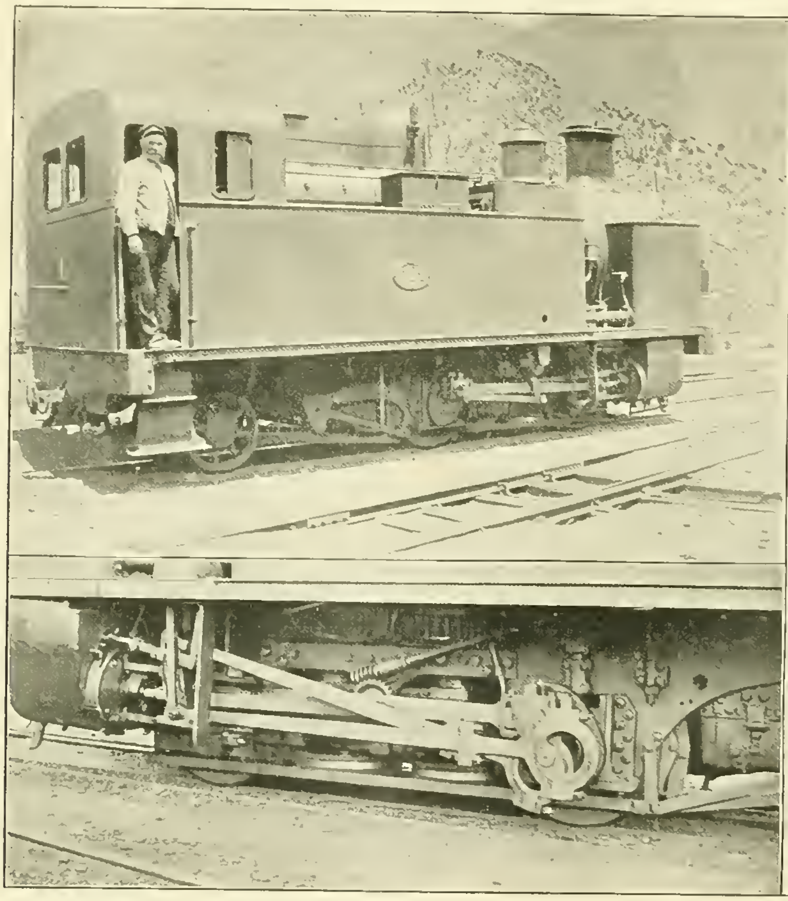
LATEST PASSENGER ENGINE OF CHICAGO & NORTHWESTERN, ATLANTIC TYPE.

The Injector Department of William Sellers & Co., Philadelphia, Pa., have issued a vest pocket edition of a "Handbook of Injectors," written by the well-known authority, Strickland L. Kneass. This has been issued for the use of railroad men and is clear and practical in every particular. While it deals primarily with the Sellers injector, it is not solely an advertisement, but gives valuable information about injectors in general. It will be sent to any railroad man who writes for it.

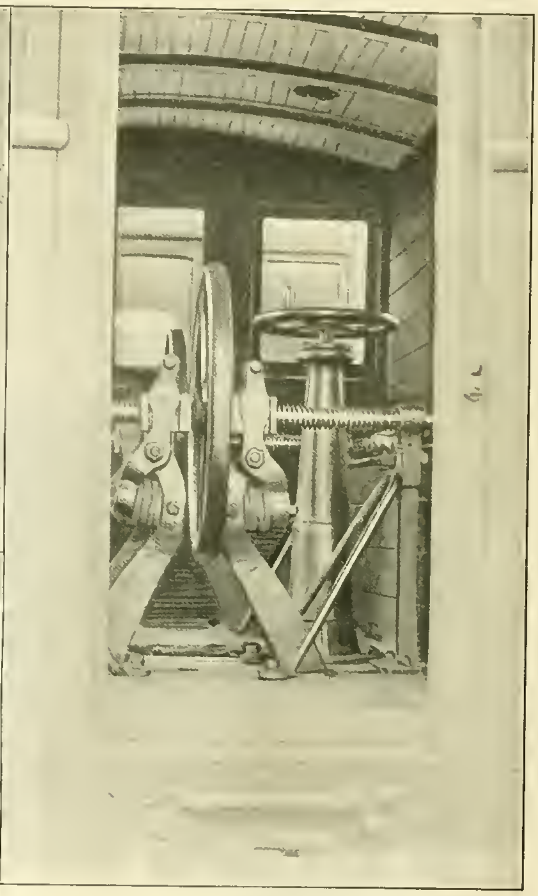
A Mountain Railway in New Zealand —The Rimutaka Incline.

BY A. P. GODBER.

This interesting portion of the world's railways is situated some 35 miles from Wellington, the capital city of New Zealand, and is reached after a run of about two and a half hours. The Summit, as the station at the top of the incline is called, is 1,141 feet above the sea level. The length of the incline is 3 miles; the average grade, 1 in 15, or 6½ per cent. (353 feet per mile); gage, 3 feet 6 inches, which is the standard for New Zealand. What makes these three miles of railway so interesting is the manner in which the trains are worked, the system employed being



A HILL CLIMBER—VALVE GEAR AND GEARING TO CENTER ENGINE.



A PEEP IN THE BRAKE VAN.

known as the Fell center-rail system. In addition to the ordinary rails, a double-headed rail, laid sideways, is securely fastened to the cross sleepers at a height of 6¼ inches from the top of the side rails to the center of the middle rail. There are three tunnels to be passed through, the longest being 649 yards long, which is situated a short distance from the summit. The other two are 154 yards in length.

The line abounds in numerous curves, a number of which of 5 chains radius, the largest radius being 10 chains. The longest length of straight line has been humorously designated the "Long Straight," and is a little less than a quarter of a mile long, so some idea may be had of the strains to which the draw-gear of vehicles traveling over this portion of the road is subjected. Special locomotives and brake vans are employed for the incline job. The locomotives have outside cylinders, 14 x 16 inches; four coupled wheels and a single bogie under the cab; all wheels being 30 inches diameter. Six engines are employed of this class, four of which are provided with Stephenson link motion, and two have the Joy patent for the outside engine. The pressure of steam carried is 145 pounds per square inch.

In addition to the outside engine, another set of cylinders, 12 x 14 inches, is placed under the smokebox, being connected to four pairs of "gripping wheels," two on each side (which work in axle boxes), placed at right angles to the ordinary carrying wheels upon which the engine runs. The back "gripping wheels" gear into one another by cogs, and are connected to the front pairs with coupling rods in the ordinary style. The wheels at the bottom are flangeless and are forced against the center rail by powerful laminated or flat springs. Thus the term "gripping wheels" is rather misleading, as they work solely by adhesion, the adhesive force being obtained by the aid of the compression springs. Two regulators and two reversing levers are on each engine, and the center and outside engines must of course work together, or the benefit of the center rail would be lost. The drivers employed have got the knack of working the engines smoothly. The center engine is used only on the up trip. Some people make a mistake and think it is used on the down trip as a brake, but that idea is erroneous and would hardly work out in practice. The valve gear of the center engine is a modification of the Walschaert type. Both engines and vans are provided with powerful brake gear, which operates on the middle rail.

The photograph of the interior of the Fell brake van shows clearly the arrangement. On turning the wheels, which are keyed on the screwed shafts shown, the vertical levers going through the floor are extended or brought together, which causes the opposite motion at the bottom. In this way the lower ends, to which are bolted cast-iron blocks, are forced against the center rail, and so prevent the train taking charge down the hill. These brake-blocks rarely last more than two trips. This extra brake gear is necessary, as the ordinary gear would be insufficient on account of the severe grade.

The engine brake gear is arranged somewhat different to the vans, but it acts the same way. In case the train did "get away" on its trip down, there is provided, at Cross Creek, the station at the foot of the incline, a "runaway" siding leading up the side of the hill. The siding can be seen in the left of the illustration of the "Creek." As soon as a train leaves on its journey up, the points are set for the "runaway" line, and are not altered for the main road till the recognized signal is given by the next train down, viz.: one long whistle. The limit of speed coming down is 9 miles an hour, and 5 miles an hour is the average going up. The grade effectually prevents any record-breaking.

At a point 20 feet from the beginning of the center rail in the Summit tunnel a gong is fixed, operated by the wheels of wagons, etc. When the engines and vans are over the center rail, the center brake as well as that on the ordinary wheels is screwed on, and the train literally slides down. The maximum load that may be taken down the "bank" at one time is 150 tons, and then two Fell engines and vans are to be employed. The average load up the incline for one Fell engine is 60 tons.

Of course it is understood that other classes of engines are unable to work over this portion of the road on account of the ashpan and other details, which would foul the center rail. In commencing the ascent, the train draws up till the engines are over the commencement of the middle rail, when it stops, and driver and fireman "screw on" the center engine wheels with the worm and wheel shown in the accompanying view of the center gear. The incline has been open for traffic for twenty-two years, and only one serious accident has happened during that time. The fatality occurred about two years after the opening. At certain portions of the line deep gullies or ravines are crossed, down which the wind sweeps with an almost resistless force. A train composed of an engine, two cars and a van was laboriously climbing the incline, when, on reaching one of the before mentioned gullies the wind swept the two cars off the track and down into the gully on the other side, some hundreds of feet below. Three people were killed and a large number injured. Considering the nature of the accident, it is a wonder all the passengers were not killed.

This portion of the line has since had substantial wooden "break-winds" erected, and the part where the train was blown over now rejoices in the name of "Siberia."

In ascending the incline, each Fell engine is placed in front of its load, and the Fell vans are put on the end of the train. In descending, both engines and vans are in front, the vans being coupled next the engines. Trains on the incline work under the absolute block system, and every van has to carry a portable telephone, so as to quickly acquaint the Summit or Cross Creek in the event of a break-down. The engine cabs are provided with doors, which are shut during the passage through the tunnels. Anyone who has had a trip up on the last engine of a four-engine train has a good idea of what "tropical futurity" may be. The wonder is how the men can stand it as well as they do. I have never heard of any other place where this system is employed, and I believe it is the only portion of the world's railways so worked, electrically worked lines excepted.

Petone, New Zealand.

LEAVING THE LIGHT BEHIND.

A CONSTANT CLIMB.

VIEWS ON THE RIMUTAKA INCLINE.

The first week in July saw a strange gathering in Dayton, Ohio, the home of the National Cash Register Works. It was the annual convention of that company, when they gather in their agents from the four corners of the earth to discuss methods of selling and show them the newest designs and their advantages. The meeting lasted a week, and numerous business sessions were interspersed with entertainment. On the Fourth, salespeople, employés and families to the number of 7,000, gathered to hear the addresses of Hon. John Barrett, late Minister to Siam. The close ties which bind employés and employer in a case like this would seem to be the best preventive of any labor trouble, and we believe it will pay any concern to investigate the system in vogue here.

Safety of High Train Speed.

Our discussion of the "Cost of High Train Speed," brought out in connection with a paper presented to the Western Railway Club on the subject, has led to considerable discussion in this country and in Europe. One remarkably good thing in connection with it is that the Chicago, Burlington & Quincy are making tests to demonstrate the difference in cost of various train speeds, which will give to the engineering world reliable information on a subject noted for the conflict of opinion that has hitherto prevailed about it. Commenting on our article upon "Cost of High Train Speed," the editor of the *Railway Herald*, of London, says:

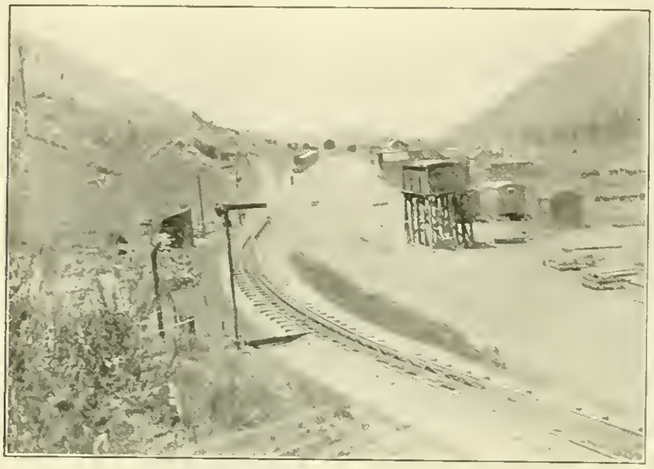
"It will be remembered that Mr. Sinclair laid stress upon the utter absence of any trustworthy data upon which a definite conclusion can be based. This is just what I have always contended. When it is alleged that high speed means higher cost, I reply in the words of the Scottish verdict, 'Not proven.' I do not intend to enlarge upon the points so lucidly developed by Mr. Sinclair. I simply ask those who are interested in the subject to read his words with due attention. They will then see why cautious and careful engineers and observers never rush headlong into such vague and untrustworthy generalization as a mere spread-eagle assertion that higher speed means increased expense or diminished profits. For they have no basis to rest upon save their own casual guesses.

"Every professional engineer knows, or ought to know, the imperative necessity of absolute accuracy and precision of statement. Often in engineering operations a difference so slight as to be almost imperceptible to the unaided bodily senses may mean all the difference between success or failure, prosperity or ruin—aye, even life or death! I write as a professional man, and therefore I lay earnest stress on the need of strict scientific accuracy in the discussion of a scientific subject. Personally, I do not care two straws whether our railways choose to run fast or not. I can always get plenty of high speed when I want it either in France or in America. But when a question is propounded which demands strictly scientific treatment, I am not disposed to deal with it in the way favored by enthusiasts or fanatics on either side.

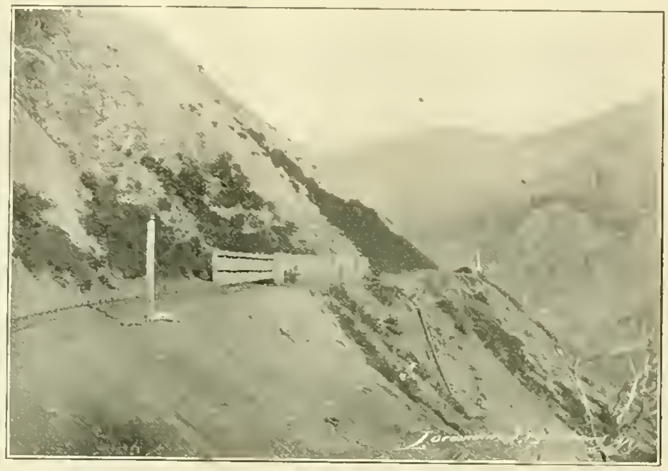
. . . .

"Looking at the speed question from the calm, impartial standpoint of a wholly independent observer, I have come to the conclusion that high speed is both safer and more profitable than low. Here, of course, I am referring solely to such portions of the line as are suitable for swift running. No sane person would advocate or extenuate running at sixty miles an hour into a terminal station such as Euston or St. Pancras, or *through* a station which is required to be worked *as* a terminal station, such as Preston, York, or Perth, or *round* such curves as those of Preston or Retford. Therefore, no sensible person will bring such places into the question at all.

"Nobody with a grain of common sense will excuse the drivers who wrecked the train at Preston, because, with rigid wheel-base engines, they ran a train round a seven-chain curve, without suitable

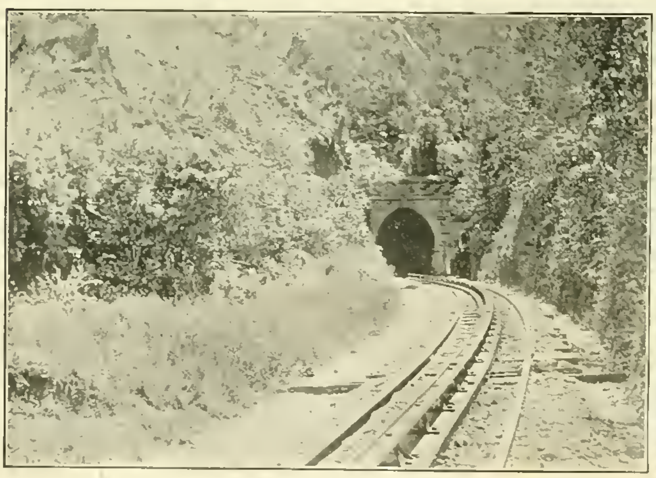


CROSS CREEK—BEGINNING OF THE CENTER RAIL.

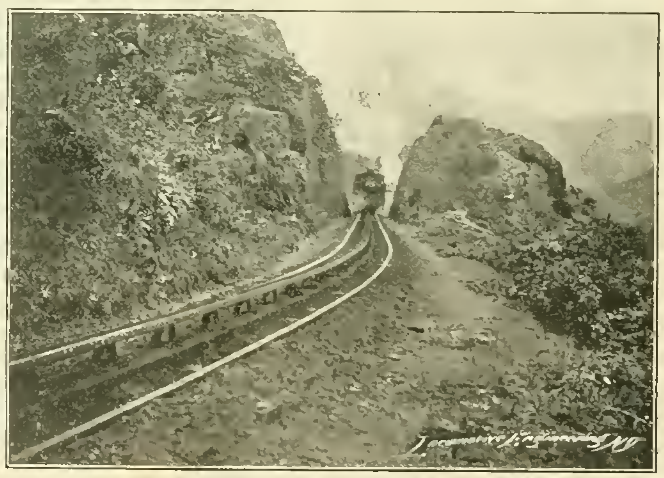


THE WIND BREAK.

VIEWS ON THE RIMUTAKA INCLINE.



THROUGH THE MOUNTAIN.



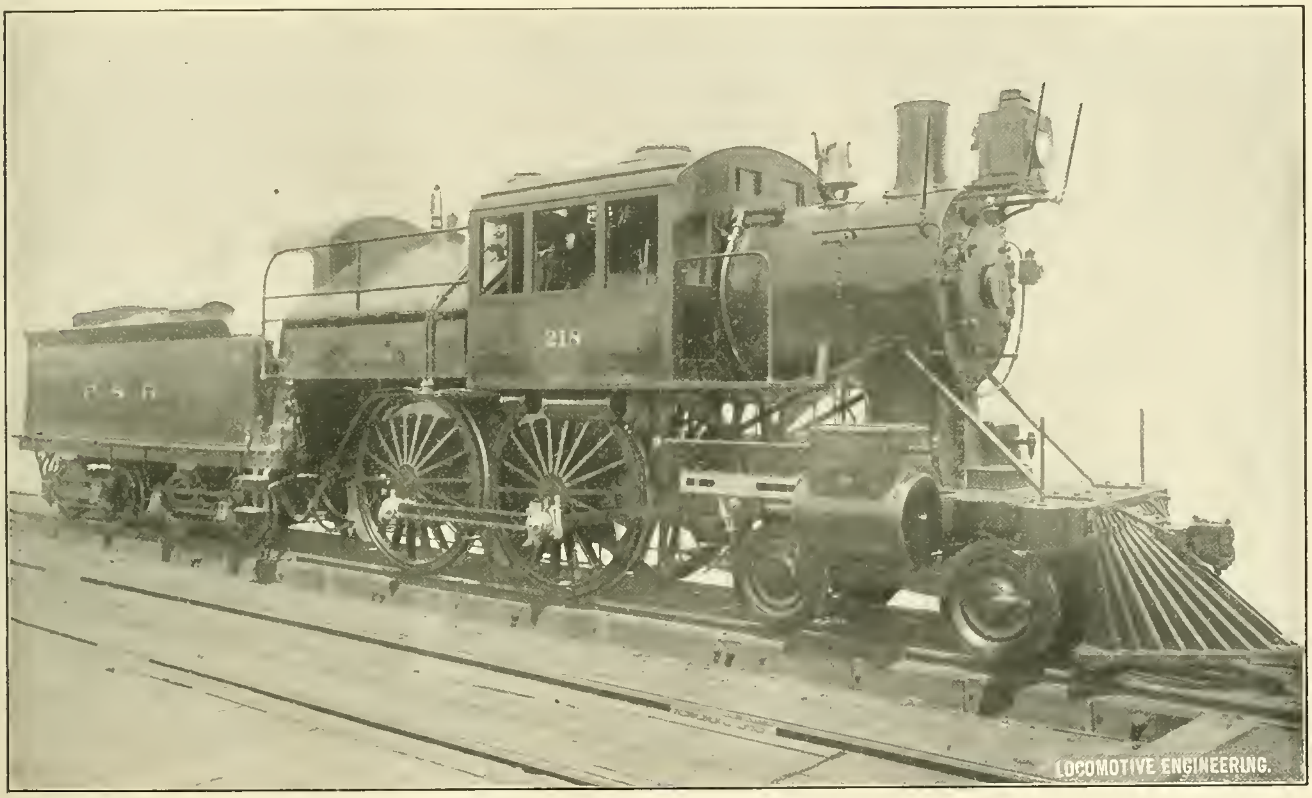
GETTING NEAR THE TOP.

VIEWS ON THE RIMUTAKA INCLINE.

check rails or adequate 'cant,' more than thrice as fast as their instructions permitted, although they had ample time with which to complete their journey—in fact, *thirteen minutes* more than that distance had previously been done in with a proportionate load. And nobody with a grain of sense will quote that occurrence as relevant. It has nothing to do with the matter.

"On the other hand, it is notorious that a serious and fatal accident near Guildford some years ago mainly owed its fatality to the slow rate at which the train was running, as at a higher speed it would have simply cut through the obstacle which wrecked it. It is equally notorious that in many collisions with gates or vehicles, or in side or oblique collisions with passing trains, the damage has been minimized through the driver increasing his speed so as to cut through the impediment when its avoidance had become impossible. It is equally certain that the serious accidents a few years ago at St. Neots and Bytham respectively would have been enormously more disastrous in their effects but for the high speed at which the ill-fated trains were traveling. The excessive weight on the single driving axle broke the rail in one case and bulged the road in the other, but each train was running at about seventy miles an hour, and so its impetus carried most of it safely over the broken part, only the last vehicle or two being wrecked. Had the speed been only thirty miles an hour, the excessive weight would have rested all the longer on weak points in the road, and when that had given way in all probability the entire train would have become one huge mass of wreckage, death and mutilation.

"It is one well-known and widely-recognized feature about high speed that as a rule it *compels* the road and rolling stock to be of the best possible quality and design, and to be kept always in tip-top order. The slow traffic, as well as the fast, benefits consequently. And when high speed along the safe parts of the road is the rule, there is all the less likelihood of drivers employing excessive speed over dangerous curves or junctions, or through large stations. Why should they try thus to save one or two minutes when they could more easily, and with entire safety, pick up eight or ten, or more, along the good part of the route?"



PHILADELPHIA & READING ENGINE, REBUILT BY MR. S. M. PRINCE, S. M. P.

A Rebuilt Reading Locomotive.

This engine has been remodeled by Mr. S. M. Prince, Jr., superintendent of motive power and rolling equipment, of Philadelphia & Reading road, from one of the old standard locomotives of that line which we are all familiar with. The boiler was raised to admit the change of wheels from 68½ to 78 inches in diameter, the center of boiler now being 9 feet 2⅜ inches above the rail. Raising the boiler made it necessary to remove the pop valves and whistle from top of dome and put them on an auxiliary dome back of cab. Mr. Prince believes this is an ideal type of high-speed passenger engine and calls attention to the fact that the capacity could be considerably increased without exceeding the limits of weight per wheel now allowable. He pertinently says: "When capacity is demanded beyond the limits of the American or eight-wheel type, then add another pair of drivers, not trailers of the Columbia or Atlantic types. The conditions as to rigid wheel-base are practically the same, with the advantage in favor of the ten-wheel type that the weight on trailer is used for tractive power, which permits increased cylinder capacity, with such addition to boiler volume as to add little to the total weight."

Some of the details are interesting. The wheel center is of cast steel, and is cast solid—i. e., the rim is not divided for shrinkage, this being provided for by an elastic mold. The cylinder fastenings are also novel, being entirely without bolts, as will be seen from detail cuts on following page. As will be seen, there is a large horizontal wedge, 7½ inches wide and 38 inches long. The frame is slipped up through the saddle into the recess, and the wedge holds it in place. The binder below takes the strain imposed on the casting by this action. End wedges hold the cylinders from movement in either direction and are capable of adjustment. The side wedge is held by a ⅞-inch bolt drilled in position. (See pages 334 and 335.)

The throttle rigging is also out of the usual, but needs no explanation. The main dimensions follow:

Weight on drivers—76,300 pounds.

Weight on truck—39,400 pounds.

Weight, total—115,700 pounds.

Wheel-base—Total of engine, 21 feet 1 inch; driving, 7 feet; total (engine and tender), 47 feet 4⅛ inches.

Length over all, engine—33 feet 8⅝ inches.

Length over all, total (engine and tender), 57 feet 11⅜ inches.

Height, center of boiler above rails—9 feet 2⅜ inches.

Height of stack above rails—14 feet 3 inches.

Heating surface—Firebox, 169 square feet; tubes, 1,168 square feet; total, 1,337 square feet.

Grate area—76 square feet.

Drivers, diameter—78 inches.

Truck wheels, diameter—33 inches.

Journals, driving axle, size—8½ x 12⅛ inches.

Tender truck wheels—33 inches.

Sight feed lubricators—Detroit.

Front and back couplers—Gould.

Safety valve—Prince, muffled, 3 inches.

Steam hose coupling—Gold.

Sanding devices—Leach.

Injectors—Sellers.

Brake equipment—Westinghouse.

Rod packing—United States Metallic Packing Company

A Letter on Soda in Answer to an Inquiry.

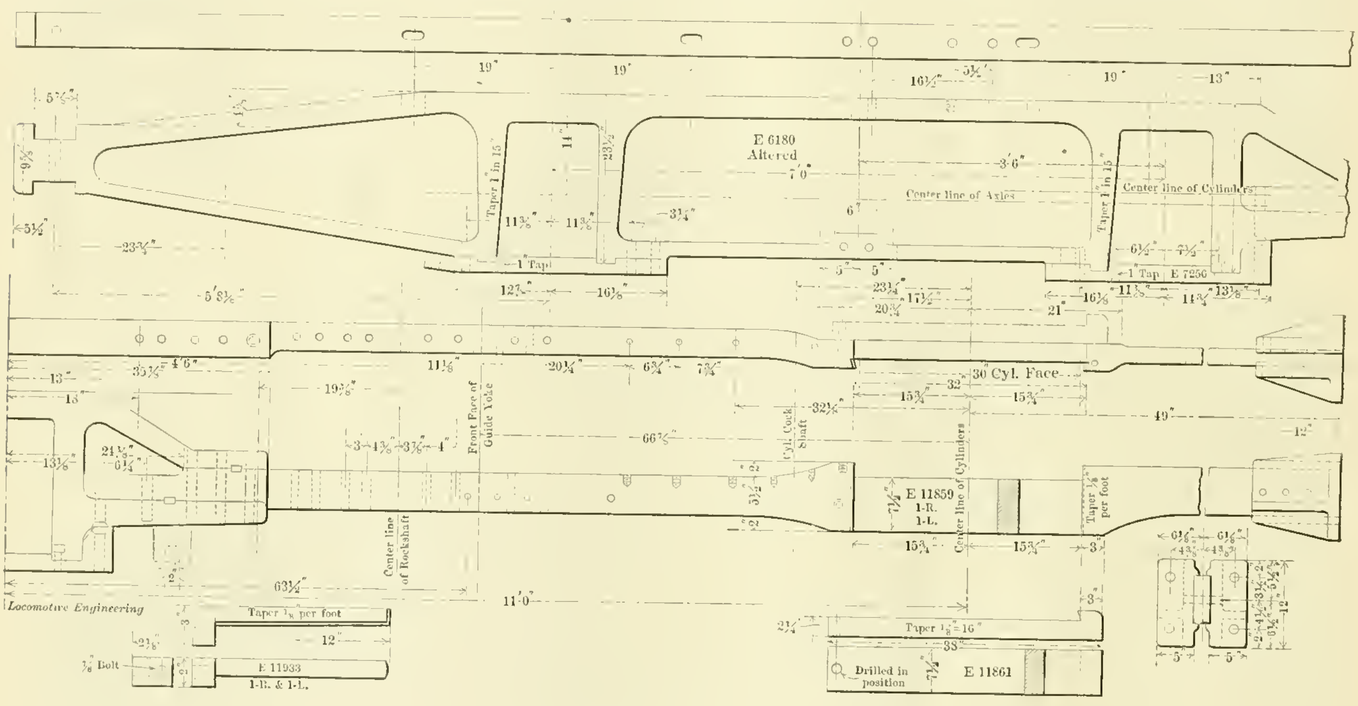
BY DR. W. H. EDGAR.

Your letter of inquiry of the 19th inst. received, and will say in answer, relative to the action of soda ash or caustic soda in a steam boiler, as follows:

Caustic soda, which is commonly known as concentrated lye (sodium hydrate); larger quantity in solution, when the salt of soda will then cake at the bottom or hottest parts of the vessel.

Sodium salts are not volatile, nor will they evaporate or carry over as a gas by distillation or sublimation. So you readily see that the soda found in the condensation, the engine cylinder and through the steam system does not volatilize and carry over or pass over by itself; it is carried over mechanically and not chemically or physically, which I will explain later on.

Will further state in answer that if your steam is perfectly free from moisture when delivered from the boiler, it will not contain nor carry any soda, as it is the moisture which holds or contains the soda salt in solution, and if this moisture is left behind, we also leave all trace of soda behind.



FRAME DETAILS OF REBUILT ENGINE.

Journals, truck axle, size—5¼ x 10 inches.

Main crank pin, size—5½ x 5 inches.

Side-rod pins, size—5 x 4½ inches.

Crosshead pins, size—3⅞ x 3 inches.

Cylinders—21 x 22 inches.

Valves—Richardson balanced; greatest travel, 7 inches; outside lap, 1¼ inches; inside clearance, ⅛ inch; lead in full gear, 1-16 inch.

Boiler, working steam pressure—160 pounds.

Boiler, diameter of barrel at front sheet—57½ inches.

Crown sheet stayed with radial stays.

Dome, diameter—27¼ inches.

Tubes—Number, 324; outside diameter, 1½ inches; length over sheets, 9 feet 2¼ inches.

Firebox—Length, 9 feet 6 inches; width, 8 feet ⅛ inch.

Tank, capacity for water—4,000 gallons.

Coal capacity—5 tons.

soda ash, which is carbonate of soda and, when in crystal form, is known as sal soda or washing soda; bi-carbonate of soda is the same as carbonate of soda, except it only has one-half the quantity of soda, the other half being displaced by hydrogen; sulphate of soda, which is commonly known as Glauber's salts; chloride of soda, which is table salt; nitrate of soda, found in large quantities in South America and used as a fertilizer, and also in obtaining or producing saltpeter; fluoride of soda, which is the combination of hydro-fluoric acid and soda; phosphate of soda, which is the result of the phosphoric acid and soda, and so on, a soda base being combined with these acid radicals, forming the different salts of soda. The above salts that is, all salts of soda, are soluble in water, more so in hot solutions, and do not and will not precipitate out of solution until the solution becomes saturated so that it will not hold any more or

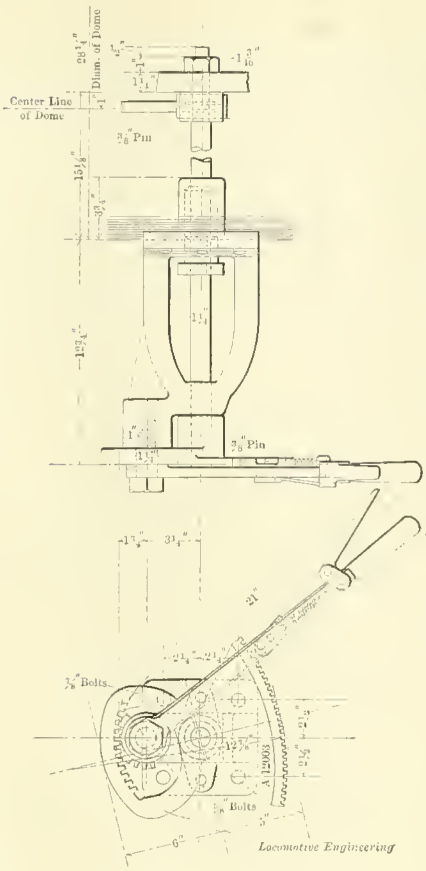
Answering another question, if one pound of soda—that is, caustic, sal or soda ash, or will say further any salt of soda—be dissolved in a given quantity of distilled water, and the water boiled and evaporated, what remains? will state that your entire amount of soda would remain; there would be no loss whatever. You would recover all the salt you had in solution, except careless boiling causes the water to be spattered out of the dish; of course all solid body of moisture spattered and lost contains just so much soda. This is the only possible way you could lose any part of the salt you have in solution.

Will state that the term "salt" means the combination of an acid radical and a base combining to form a neutral salt. Soda combined with different acids forms sodium salts. Lime combined with different acids forms lime salts. The same with magnesia or any other base, combined with a corresponding acid radical, forms a neutral salt, named correspondingly with the acid radical with which the base is combined. So the term "salts" means all such.

You understand that soda ash is washing soda and what we use to make soap. We also make soap with caustic soda. Soap is the result of the action of the soda base combining with the fat or oleic acid, forming oleate of sodium. This gives us soluble soap. The carbonic acid gas, combined with the soda, is carbonate of soda or soda ash; or the hydrate combined with the soda as caustic soda, is easily and readily displaced by the oleic acid, the soda having a greater affinity for the oleic acid than it has for the carbonate or hydrate radical. This is called saponification. You know very well what soap would do in the boiler; you know its action in the water; it forms suds; it foams. Now, the soda has the same action on the water without grease or soap. We do not, nor can we, get this action from a chloride of soda, a fluoride or a nitrate of soda. These three, chloride, fluoride and nitrate, belong to the same group; their physical and other peculiarities are very similar.

Combined with soda, the affinity between the soda and these acids is so great that it will not break up to go to another acid radical, consequently we cannot saponify the water and cause consequent foaming by the use of these salts nor by use of phosphate or sulphate. But a sulphate will give off to some extent, softening the water by breaking up into a hydrate when in a boiling solution.

Now, when you use caustic soda or soda ash, introducing same into your feed water, you saponify the water in your boilers, causing it to foam, suds (little bubbles to form), which break up and spatter the steam, and the water being more sudsy, the steam is spattered that much more, and these little, minute, solid sheets of water are virtually blown over. The great velocity with which the steam is leaving your boiler carries this moisture over mechanically, and when you have soda in solution, naturally any part of that solution carried over takes over just so much soda. Any grease or dirt that may be in your boiler or water will form just so much more, or, that is, cause just so much more of this saponifiable condition, causing more violence or perceptible foaming.



DETAILS OF THROTTLE.

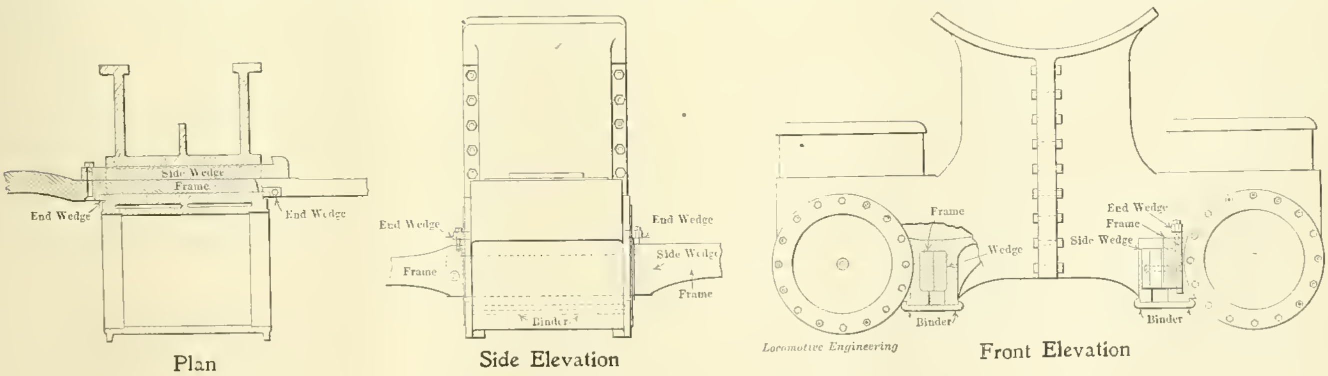
Soda ash or caustic soda carried into the cylinder of the engine cuts the cylinder oil, forming soap with the animal or vegetable part of the cylinder oil, and mechanically coagulating into a sticky, non-lubricating mass the mineral part of the cylinder oil; consequently your lubrication is destroyed. The same action takes place in a boiler where you have oil coming back in the returns.

Soda carbonate and soda hydrate saponify the animal oil, forming soap, which gives you violent foaming. It cuts and coagulates the mineral oil into a mass.

A word on oils. Where you are constantly buckling the tubes in a water-tube boiler, or bagging the sheets in a tubular boiler, or the back ends of the tubes of a tubular boiler are constantly leaking, it is due to oil coming into the boilers with the returns. The animal or vegetable oil, combining with the lime and magnesia as oleate of lime and magnesia, most of the lime and magnesia being in the form of a carbonate, the carbonic acid is readily displaced by the oleic acid. These oleates of lime and magnesia are insoluble, because the oleic acid has combined with an insoluble base. This oleate of lime is formed on top of the water in little globular masses. These little particles are very adhesive and sticky; they gather together, forming into a mass, and then become of the gravity equal to the gravity of the water, and are carried buoyantly with the circulation. They always adhere mostly around the ends of the tubes or in the lower water tubes, because this substance has a greater affinity for the hotter metal than for the cooler parts of the boiler, adhering on to a hot surface more rapidly. Being a perfect non-conductor of heat, it concentrates and checks the heat in these given parts, preventing the water from absorbing the heat units, consequently the metal is brought up to such a degree of heat that it melts; the pressure within forcing the metal out, buckling the tube or forming a bag.

The mineral oil combines with the lime and magnesia as a mechanical mixture in a coagulated, sticky mass, incorporating with and forming a part of the general mass, all of which is insoluble and very adhesive.

Further, will say that this *mechanical mixture* is also formed with common salt (chloride of soda), or the fluoride or the nitrate of soda. Any one of these three will form a more sticky, tenacious, adhesive, coagulated substance mechanically with the oil, both mineral and animal, and in a hot solution far worse than the combination with lime or magnesia. This is formed because the affinity between the fluorine, nitrogen and chlorine with a soda is so great that it does not break up, but enters into a mass with the oil; so wherever you may be getting a little oil back in your returns, a fluoride or chloride of soda will cause your boiler to leak and



CYLINDER FASTENINGS OF REBUILT ENGINE.

bag more quickly, and the action is more vicious than the action with lime.

When we say lime, we mean the natural scaling salts in your feed water. Now, where you are using the average feed water, you have carbonate of lime and sulphate of lime, which form scale, and, when you use soda ash, it is for the purpose of furnishing carbonic acid or carbonate to give you a double salt or enough carbonate to make your lime soluble as it originally was in solution as a bi-carbonate ("bi" meaning two of the acid and one of the base). But you readily see that you have your soda in solution, consequently you get the soda action, foaming, etc.

Hydrate is used because lime salts are soluble in an excess of the hydrate, but this excess gives you the same trouble. Chloride of soda has no action on the lime, as the chlorine has a greater affinity for the soda than it has for the lime. Fluoride is introduced with the object of converting the lime carbonate and the lime sulphate into fluoride of lime, which is a flocculent light precipitate. But you readily see that where your fluoride goes to your lime your soda goes to the carbonate with which the lime was combined and leaves the soda ash in solution, so that at the end of two weeks' or one month's run your solution in the boiler is saturated with soda ash. Consequently, you get a soda action, your water is saponified and carries over, your valves and connections are all eaten out from the same old soda action.

Then, again, the fluoride of lime, which is formed and which would remain as such in a cool solution, is broken up to a great extent in a hot solution, due to high heat in a steam boiler, which the average chemist does not stop to figure and think of. When this fluoride of lime breaks up, you get the oxide of lime and free hydrofluoric acid. The hydrogen of the water combines with the fluorine, forming hydro-fluoric acid, and the oxygen of the water goes to the lime, forming oxide of lime.

This hydro-fluoric acid liberated attacks the metal and eats the iron, it being much more corrosive and vicious than even sulphuric acid. The oxide of lime forms a scale just as readily as the carbonate.

Soda is so extremely cheap that these fakirs, who have a living to make, can afford to sell any preparation of soda and make 1,000 per cent. profit; and the prices that they get are such that all they need to do is to sell one or two kegs per week. They care not for your boilers, and if they did their knowledge would not help them out. They know nothing about what they are selling, but they talk the same as all soda dopes have been handled in the last twenty or thirty years.

If you are going to use soda, buy your own. Phosphate of soda, whether it be tri-sodium phosphate or the other soda phosphates, is used with the same purpose in view; that is, of converting the lime carbonate and the lime sulphate into phosphate of lime, known or claimed to be tri-calcium phosphate. But you readily see that the phosphate going to the lime, the soda must go to the carbonate, sulphate or hydrate, and you get the same action, the results are always the same, the soda ash being left in solution.

You will notice one thing. They will all explain to you the action on the lime, but they do not tell you what becomes of the soda. The man who is selling it does not know; the chemist who got it up does know, but he takes good care that you do not know through any fault of his.

When a water is too pure and not satisfied with lime or some proper substance, such as the return condensation or distilled water, it attacks the iron. The action is termed electrolysis; more properly speaking, galvanic action. Whenever you add soda to too pure water, or you add enough soda so that you have an excess of same over the lime, you then have too pure and an unsatisfied water, which immediately acts as the electrolyte between your poles, giving you the battery connected and your positive pole, which is always the iron, is destroyed; consequently the pitting, grooving, etc., and general action on the joints and connections takes place.

The only salt of soda that can be successfully used is the tannate of soda, and then only when used with four times its weight of tannin. Also with a large excess in weight of sugars, mixing the sugars to handle the sulphates and the tannins to handle the carbonate. These mixtures can be used without any foaming or deleterious action to the iron.

It is a subject in organic chemistry all by itself. You can buy these substances at the wholesale drug store. The reason these soda dopes and soda salts have been used so extensively throughout the country in the face of the fact that the joints are all leaking and you have the steam connections clamped up with these protectors, withstanding all this deleterious action, and the boilers being only half clean, is due more to the user being under the persuasive power of some salesman or man whose business it is to keep the user worked up on theory and talk when, if an engineer would read chemistry and would figure out the reactions, remembering that there is always a by-product and a main product, and when he figures out the main product he must be sure and figure what becomes of the by-product. When we take we must give in all chemical reactions. We must take, and if we do not give we must produce.

The Lackawanna road is making extensive changes and improvements in the tracks at their Hoboken terminal. They are taking out the old "kinks," and the improvement in the riding of the cars here is very noticeable.

A Problem.

One day when the Sand-House Committee had got switched away from their usual subjects by the question of a young fireman, as to what work took the best design of valve motion, "to get the steam into the cylinder at the right time," or "to get the steam out of the cylinder at the right time," one of the old runners who did not usually have much to do in the way of answering questions said:

"Most any kind of a valve motion will open the steam port at the right time to let live steam in there and close up to cut off steam, if the eccentrics are set right to suit the lap of the valve. But when you expect the same valve to do this work to suit the ever-changing demand for power to haul trains of various weights at various speeds, and at the same time let the steam exhaust at the right place in the travel of the piston, *after* it has done its work of moving the piston and *before* it begins to hang back so it must be pushed out by the live steam on the other side—this valve must be set by a dandy who understands the business.

"If you exhaust the steam too soon after the cut-off, it comes out at a high pressure, so you lose some of its expansive power; this is a waste, and causes stalling on hills.

"If the exhaust is too late in the stroke, the steam cannot get out in time, which reduces the speed of the fast train. All of you know about this trouble of working a full throttle and long cut-off at high speed—the engine slows down.

"I tell you, boys, the valve motion has to be designed to do so many things in the admission of the live steam and the release of the exhaust steam, that the wonder is that the work done is so satisfactory. I am no valve-motion designer, but I fancy most of them use a 'cut and try' method, to get as many good points in and leave as many of the defects out as possible.

"What will make the fast pace of the Limited won't suit on a heavy grade with forty loads. The switch engine that is worked in the corner all the time has no use for fine figuring with expansion and close cut-off."

He went out; there was a close silence, opened by a question by one of the committee, about whether "they had raised the tonnage of trains 49 and 50 any higher?"

This showed that the tonnage question is more of a live issue than valve motion, although it is a proper design of valve motion that makes high tonnage possible.

Flange friction in a car truck has considerable to do with a train pulling hard out of a side track. If weak bolsters or transoms allow too much of the weight to rest on the side bearings it will keep on pulling hard till the speed is sufficient to swing the car body from side to side and square up the trucks.

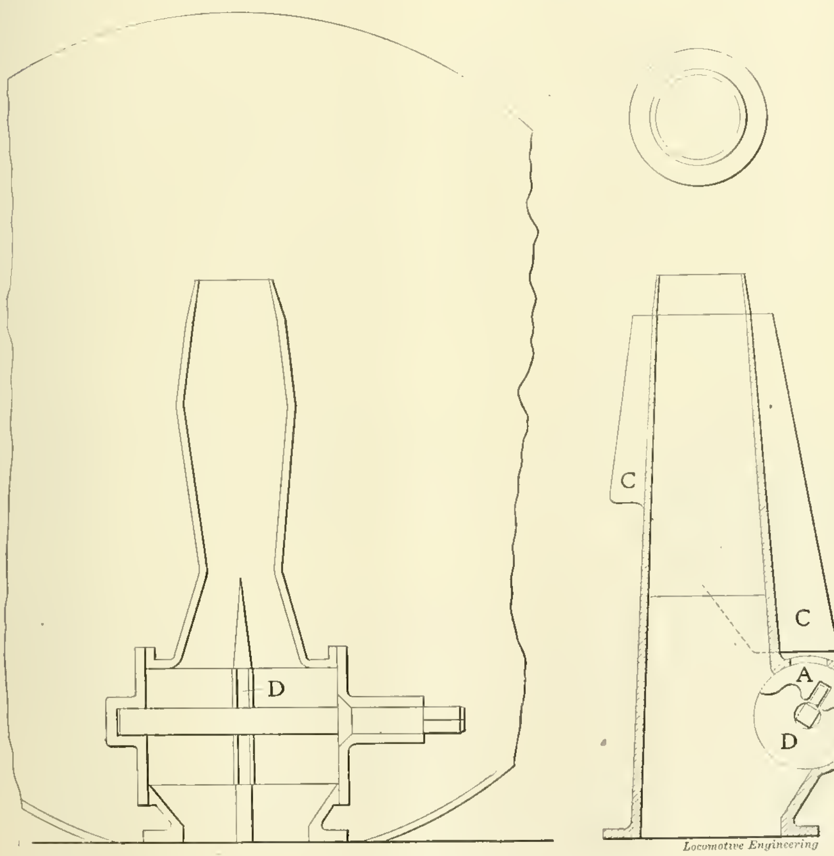
General Correspondence.

All letters in this department must have name of author attached.

A Variable Exhaust Idea.

Now that the question of variable exhausts is up again, I submit one shown me by an old railroader, one who is an encyclopedia on locomotives since the days of the Ross Winans "Camels." The two views make it clear as to its action, and the opening of this in stations would do away with much of the sharp "barking" that is so annoying to passengers, and so unnecessary.

It is shown applied to a regular single nozzle with partition, and there is also a disk *D* in the valve or cock which maintains a separate exhaust until top of partition is reached. The segment *A* opens and closes auxiliary port *B*, same as a Corliss valve. The hood *C* extends around the nozzle and makes an annular nozzle at top (see top view).



VARIABLE EXHAUST.

The main nozzle would be made the smallest size necessary for good work, and any increase in area that could be used would be obtained by the auxiliary. Throwing it wide open would relieve the noise in and around stations and prevent much of the profanity which now paints the air blue as a trainload of people try to hold converse with each other while another train backs out.

FRANK C. HUDSON.

Tombstone, Arizona.

Handling Disabled Locomotives.

In answer to Mr. A. J. O'Hara's letter on page 240 in June number, I think that a device, as he illustrates, to get off the dead center when engine is on one side, will be considered by all practical enginemen, as a step backward—same as placing an air whistle on train line to call the engineer's attention to the fact that he has lost the train line pressure to a point to be dangerous to good management.

Speaking about being caught on the center at night-time, can he say positively that he can stop in daylight at all places and not be centered, he having a 95-ton engine, in which case one pinch bar is useless?

Suppose he cuts out driver brake and, when almost stopped, puts reverse lever in opposite motion and opens throttle; be it daylight or dark, engine will stop so she can be started again.

In case of taking down one side, if valve gear is disabled, what should prevent main rod being left in place, and should engine become centered, why could not valve be moved by hand forward or back and steam admitted, and thus move one quarter turn? The reason may be given, to leave main rod up will endanger cutting of cylinder. In practice an engine will drift down hill 10 to 20 miles and engineer entertains no fear of cut cylinders. Should it be that engine had 100 miles to go before reaching a repair shop, would it not be far the quickest to remove valve stem at union near steam chest, take a bell cord, fasten around key or stem and pass one end around steam chest and the other end around guide yoke, remove indicator plugs on sides near ends of cylinder, and oil through same, or remove front cylinder head and with a piece of waste oil the inside of cylinder, using a piece of the canvas curtain as cover to prevent dirt and sand entering and cutting cylinder, which can be inspected at intervals and no risks taken?

In passenger service the delay would be comparatively small, and train would do the braking for itself and engine until almost stopped. Brakes can be released and lever reversed and train stopped with no more shock to passengers than ordinarily.

Chicago, Ill. H. G. KULL.

Emergency Repairs.

In the roundhouse machine shop there are a great many new appliances to do the work with as well as methods of doing it, but some of the old ways are good to use in a pinch. Some years ago I was working in a roundhouse in the far Southwest, when an old Roger engine came in with the inside top crosshead gib (a four-bar guide) lost out. There was none in stock, so I thought that a temporary one of oak would do, and made one. It was made a little thin and then was soaked in oil to swell. I then put it in and put the plate on. She ran a week before she got to the shop for a new one of metal.

It is often advisable when you can't get babbitt metal to fix a rod brass, to put a piece of wood or sole leather in the babbitt recess in the brass. Leave the wood or leather a little below the surface, so that when saturated with oil it will not bear too hard on the pin. It will often run a long time. H. COOK.

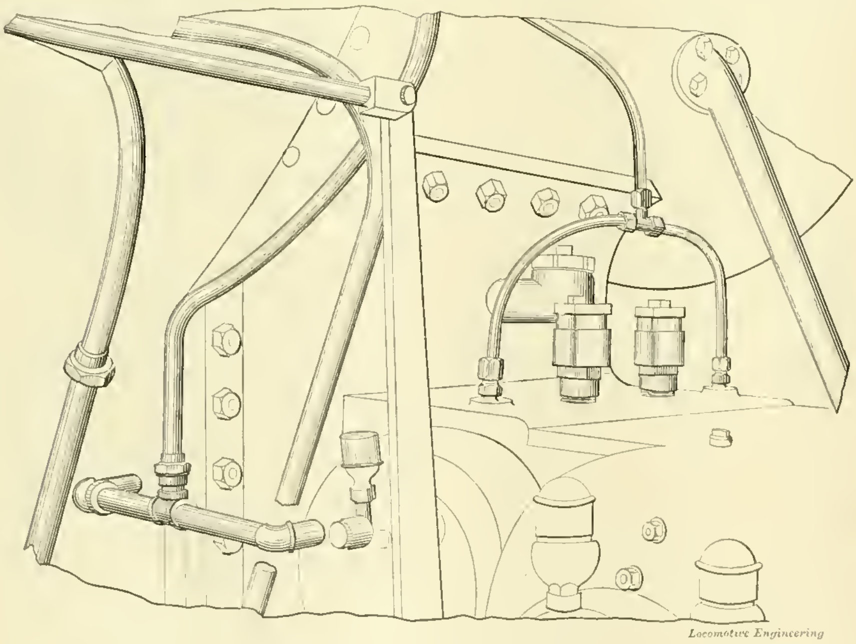
Pittsburgh, Pa.

Split Air Pump Exhaust.

Answering yours of a few days ago about additional information regarding relief valves in our compound engines, we have one of these in live steam port in side of saddle and one in each low-pressure port, making three valves on each side of engine. I enclose a photograph which, I am sorry to say, is not a good one. It shows the relief valves up very plain, but one end of the split air-pump exhaust pipe is partly hidden behind the valve stem, as the artist did not set his camera high enough to get it all into his picture. We removed the valve rod before taking the picture, in order to have an unobstructed view.

Trusting that this will make this matter clear to you and that you will call on me for additional information, if required, I remain HUGO SCHAEFER, M. M.

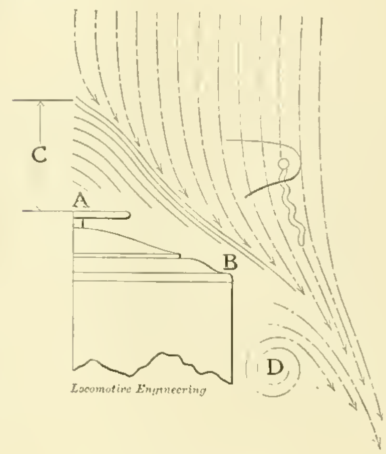
[The engraver has not shown this exactly correct, but it will be clear to any railroad man. The photographs were very dim, as stated.—Ed.]



SCHAEFER'S SPLIT AIR PUMP EXHAUST.

Action of Atmosphere on Front of Locomotive.

When an express is running at very high speed against, or head on to, the average wind (in fair weather) I believe the backward pull on the last car exceeds the resistance encountered by the locomotive. The train acts like a piston in a cylinder sucking air, and the vacuum or suction produced takes a good tight hold of the last car—similar to the air piston of the air pump trying to suck in a good breath of fresh air when the receiving valves are gummed up with a lot of bad oil. The wedge of air forming in front of the engine no doubt exists; there are many different effects produced which go to prove this. I believe the apex of this wedge of air has an oval form similar to accompanying sketch, and that laterally it slants back at an angle about parallel to a line run from the nose of pilot to top of headlight or stack. I believe the pilot of a locomotive helps it through the air (not because it acts as a wind splitter), but because the nose gets under the air, and this gives the wedge of air which forms, more of a backward slant. The slanting front of American locomotives no doubt penetrates the air better than the abrupt, vertical front of British engines. Point *A* has less pressure than point *B*, because the air wedge (which acts as a cushion) has its greatest depth at *C*. I believe at point *D* a spiral of air forms; this is what sometimes causes an indicator diagram, or other light substance, to apparently hesitate before it shoots out to the side. Who ever saw a signal flag flown from the pilot line straight back? A flag will line out more to the side than that shown in curved lines on the sketch; this is because the lines of air shown are taken at center of boiler, and would be farther forward at deck of pilot. This wedge of air given to us by nature is exactly the correct form, whatever that form may be proved to be, and far exceeds any wind splitter that man could devise. A stiff quarter or side wind with the flange friction—that's the rub, and you are *four* times as liable to get this kind, as you have two quarters and two sides to get it on. This side wind seems to be entirely overlooked by the advocates of wind splitters, as that "pug-nosed" device, no matter what form it may be shaped up in, presents a greater lateral surface for a side wind to act upon, and in just the worst place, as this helps to push the engine trucks over all the harder against the opposite rail. Nature's wedge of air is not there when a side wind strikes the train, and this wedge of air when formed has no dead weight. We shorten up the smokebox and do all that is possible to take the weight off the front end, which acts as a lever to lift the weight off the drivers, and then these fellows come along and hang wind splitters up there.



WIND RESISTANCE.

The inventors of wind splitters for locomotives, to my way of thinking, are on a par with the "gentleman" that tries to invent a successful flying machine. It's always seemed strange to me why the inventors of wind splitters didn't finish up the scheme by putting a "windmill" on the rear end, similar to a rotary snow plow or the propeller wheel of a steamship. Then he would do away with the locomotive entirely and all the string of ills that dear old girl is heir to in this way, with a wind splitter on front end of first car and a windmill on tail end of last car you would just sail right along (airship fashion). This would do away with pneumatic sanders, as adhesion wouldn't count; and it would also do away with the necessity of using air brakes; then we'd have no more slid flat wheels, and the air brake doctors could take a vacation. When you wanted to stop—w-h-y—you just reverse the "windmill"—see! If you know of any bright genius who would be likely to make a success of this, you are perfectly welcome to disclose it to him; the idea is not patented. P. EMERSON WADDELL.

Tremont, N. Y.

The Twenty-four Hour System in India.

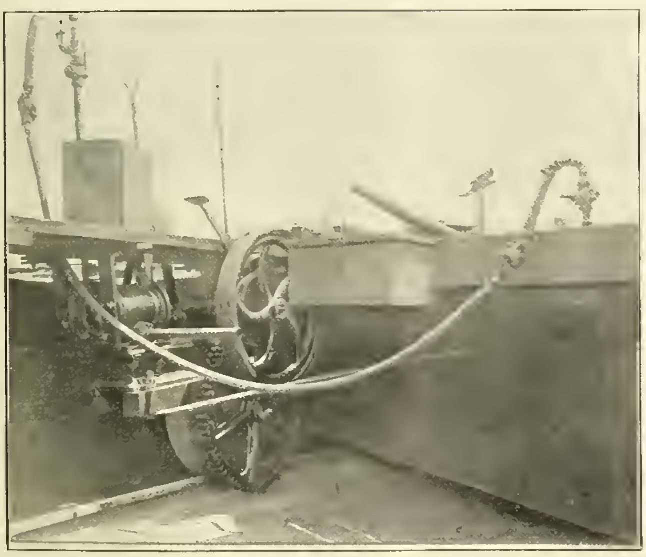
In your April number you remark that English-speaking countries have all opposed the continuous or twenty-four-hour day system. Here in India it is used on all railways and found much more convenient than the old A. M. and P. M. system. It seems rather surprising it has never been adopted in America. It would be more appreciated there than in England, because some of the passenger trains are, I suppose, two or three days on the road between starting-point and destination, whereas in England the longest trip is somewhere about ten hours.

Lucknow, India. C. H. HILL.

Pneumatic Turntable Motor.

Enclosed please find a series of photographs showing a new pneumatic motor for turning the turntable, which may be of interest to those who turn a great many engines in a day, especially if they have ever served an apprenticeship at the pole when the engines were not properly balanced.

The table at the West Oakland shops of the Southern Pacific Company is probably one of the busiest tables in the United States, averaging an engine turned about every nine or ten minutes, so that two men were constantly employed day and night in this service, costing $6 per day, besides the help they often received from others when turning a large engine or when turning two engines at a time in switching around the shops. The necessity for this motor has long been apparent, and an electric motor used for the same purpose at the Sacramento shops of this company gave us the idea. So we looked the ground over for material from which to build it. The foundation was an old flywheel water pump, discarded on account of the water end being worn out, but the steam cylinder was still in fair condition. We put on two pieces of 4 x 4-inch iron on the bottom to give it additional weight, and to make a strong frame for the main boxes. The gear wheels, one on the main shaft and the other on the crank shaft, were formerly used on a coal crane, since made pneumatic. The driver was a scrap engine truck wheel. We cut the valve stem

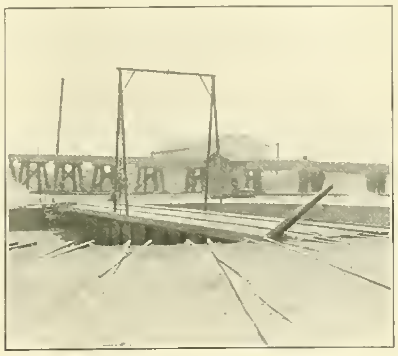


AIR MOTOR ON TURNTABLE.

OPERATING—THIS BEATS THE OLD WAY.

in two and put in a link, or rather a radius block similar to the reversing gear of the Stevens geared locomotive, raising and lowering the radius block corresponding to the ordinary link block, making it a direct engine in one motion and indirect in the other. It is supplied with a friction foot-brake, and the flywheel is drilled for a starting bar in case the engine stops on center.

It cost $90 to apply this motor to the table, allowing nothing for scrap material. It saves $3 per day, or $1,095 per year, allowing nothing for the air used, which would be more than paid for by the occasional extra labor used. One thousand and ninety-five dollars represents the interest at 6 per cent. on an investment of



AIR-OPERATED TURNTABLE.

$18,250, which the company could have made, and been considered a good investment. This is only one of many ways of doing more and better work at less cost than by hand. D. P. Kellogg.

West Oakland, Cal.

Protecting that Patch.

Referring to the letter from Mr. W. M. Morse, superintendent and master mechanic of the Toledo & Ohio Central, in the June number, about protecting the seam on a patch in the firebox of a locomotive with a tube extending from the front to the back of box, and Mr. I. J. Cundiff, in the July number, I do not believe this thing will work, unless one end of the tube is elevated considerably above the other, so as to induce circulation, as I know from actual experience that if a tube is put in a firebox horizontally, steam will form in the center of tube, driving the water out at both ends, causing the tube to be overheated and to burn out.

Hartford, Ct. Hugo Schaefer, M. M.

New Old Devices.

The only way to keep from repeating the designs of others is to find out what has been done in those lines. This is not always easy, but it will generally pay if there is much at stake. Not that old things are always bad, or new ones always good; but it is rather discouraging at times to find that weeks have been spent in devising methods that were used before we were born perhaps.

This is particularly noticeable in boilers and fireboxes, and the "widest firebox ever made" which one of the papers described finds a mate one lap ahead in some of the older engines. Fireboxes of 8 feet 6 inches by 8 feet long are hailed as monsters when the Lackawanna road has been running a firebox 9 feet wide by 10 feet 6 inches long for nearly a year. Their new consolidations have fireboxes 9 feet wide by 10 feet long.

Mid-feather fireboxes is another case in mind, as new ones crop up every few years. Patents were issued as late as 1894 to the late D. L. Barnes. Here again the old Lackawanna road comes to the front, for the engine Black Hawk, built by Danforth, Cooke & Co. in 1856, had one very similar to later ones. This did not extend clear to the grate, giving more heating surface above the fire and not so much surface to cool off edge of fire as is done by side sheets anywhere. Men always want new things, but we can learn a lot from studying old ones, too.

Scranton, Pa. John Johnson.

Things in General.

I am one of the repair men mentioned in the February Locomotive Engineering. The paper says, "Airing an idea gives no one a cold," so here goes.

Where the engines are in the pool metallic packing doesn't work worth a cent. The men will not adjust it, and it often melts out. Old rubber water hose makes the best I can find. It lasts two months.

When putting up an engine put an inch

pipe under the jacket where the oil pipe goes, then you can push a ⅜-inch copper or iron pipe through and it is easy to take out to repair.

The pneumatic sanders are no good, most of the men say. Why? Because the blower blows only the fine sand out and leaves the gravel. A box of gravel is common with all kinds of sanders. The only way with a good many is to dip it out. Then the air blows the sand off the rail. If the pipe is bent down against the wheel so it clears the rail 1 inch and presses the wheel pretty hard it will work O. K. after it wears to fit the wheel. Sand can run only when the wheels are turning, but that is the only time we want it anyway.

On these big consolidations there is no place for the main drum. Why not make the pilot a drum? It would not be very difficult. Then some use enough sheet iron on it for the front; just put a bottom and back on it and some staybolts, and you have a drum out of everybody's way.

JAS. DOWNING.

Arkansas City, Kan.

Is Asbestos a Non-Conductor?

In your July number, page 299, you say, in your editorial on the "Peculiarities of Heat": "A few mineral substances, such as asbestos, etc., are bad conductors of heat." Permit me to say that I believe asbestos to be a good conductor of heat, for the following reason: Some years ago an asbestos stove lid was put on the market in Detroit, as being an excellent thing upon which to make toast. The idea was that the ordinary round, cast-iron stove lid could be replaced by one made of asbestos, which would soon become so hot that dry bread would be readily toasted thereon.

I have seen the toasting tried on such a lid, and all I can say is that the lid got hot all too quickly, and had a tendency to burn rather than toast the bread; though, if carefully watched, excellent toast might be made on the very hot asbestos lid.

Used as a boiler covering, it is very satisfactory, chiefly because it is indestructible by heat, and in its preparation it is made very porous, and so contains innumerable minute air spaces. The enclosed air acts as the non-conducting medium, and the asbestos lasts in virtue of the fact that it is a very refractory substance—that is, it is not acted on by fire. Asbestos, when properly prepared for boiler clothing, possesses two very satisfactory properties.

GEO. S. HODGINS.

To Avoid Taking Down Main Rod.

Now that our engines are being built heavier throughout the whole country, in case of a breakdown where it becomes necessary to take down the main rod, it is quite heavy for an engineer and his fireman to handle, and besides there is no good place on our culm-burning engines to carry it, after it is disconnected. Therefore I would suggest that the builders of those heavy locomotives would make the front cylinder head strong enough in one or two places, by casting a boss on the head to give it strength, so there can be two holes in the head, 2 inches in diameter, to be run with plugs, with squares on the end of the plugs, so a wrench can unscrew them quickly. And in cases where we break down we can take out those plugs in the front cylinder head, and take out the piston rod packing in the back head. By doing this we can run our main rod up without doing any injury to the cylinders or impeding the speed by compression.

A. J. O'HARA.

Port Jervis, N. Y.

Learn First to Fire.

The first lesson in firing was, that we should keep the corners full and let the middle take care of itself. We found that this worked all right; but how did the coal get in the middle of the box? In trying to get it into the corners, we failed, and it fell short of the mark. After some practice in firing we found that we were getting too much in the corners, and occasionally there were holes formed in the center, necessitating a scoop of coal to fill it up. Then the idea came to us: if we could put the coal in evenly over the grates there would be no holes. So now in firing we spread the coal as much as possible.

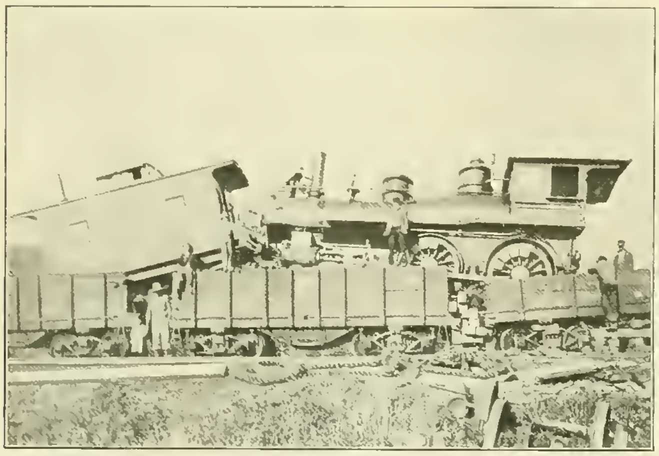
The important indicators for the fireman's use are the steam gage, the "stack" and the condition of the fire. Anyone can read the steam gage, but it takes practice to tell what different shades of smoke mean, and one must have the "fire eye" to be able to see without trouble any weak places in the fire, and at about what temperature it should be kept. Some may be able to fire by the gage alone; others by smoke, and still others by watching the fire and the gage. I believe we should use every indicator that we have, so that we may keep more closely in touch with the condition of the fire. In so doing we are having more steam and are saving more coal, and at the same time doing the work with the least possible exertion.

We are not only working for the company's interest, but our own as well. Physical strength is not all that is required of a fireman. Skill is of more value; yet both are essential, and, what's more, all railway companies realize this fact. I do not believe in the "one-scoop" firing or any other particular method, but believe we should try to adapt ourselves to what is needed to get the best possible results. Those who have had several years' experience know that no two engines burn their coal exactly alike. So we find it necessary to adapt ourselves to existing conditions.

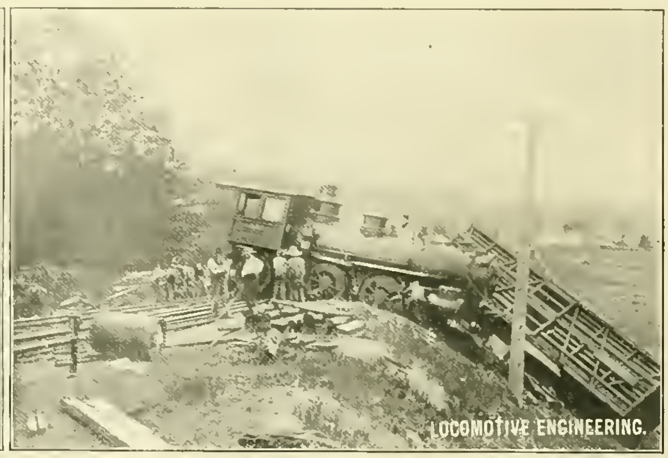
Seems to me, if the fireman would make more of a study of the improvements and defects in draft appliances, etc., instead of spending so much time on valve setting and link motion, we would be a better qualified lot of men. I do not mean by this that we should not become posted upon machinery, but let us not ignore entirely the idea that we are expected to be fireman as well as engineer.

X. T. CRAGUN,
Loco. Fireman, C. G. W. Ry.

St. Joseph, Mo.



GETTING UP IN THE WORLD.



ON THE DOWNWARD ROAD.

Draft Appliances of Extension Front.

BY THOS. P. WHELAN.

The influences of the various appliances calculated to regulate the draft of locomotives, is, one may safely say, not clearly nor generally understood. It is not by any means difficult to understand the action of draft in the locomotive; but, like all information, there must be a desire for it to appreciate its full value. The advantage of a clear knowledge on this subject will no doubt be conceded, and to the young man who is taking his first impressions of the care and management of the locomotive, it is of the utmost importance that he get proper information at the beginning, lest he find himself in later years burdened with a number of erratic theories that may prove not only useless, but confusing in his practice and a hindrance to the acquirement of useful knowledge in after years.

Beginning with the dampers, we find that the forward damper is almost invariably used to admit air to fire when engine is working. This general practice in the use of the forward damper causes the belief that the engine steams better, the apparent reason being because of the volume of air that forces itself into the firebox when the engine is running ahead. But there is no practical advantage of the forward damper over the back one in so far as the steaming of the engine is concerned—if any, the difference is in favor of the latter, to the cause of which we will give attention later. The preference of the forward over the back damper consists in its permitting less fire to fall out of the ashpan when engine is going ahead, thereby preventing, in some measure, fires that might originate from that source if the back damper was used. For the losses from damage by fire to the property of railroad companies in the past, together with the "fire claims" of owners of adjoining property, have been such as to demand the use of every possible preventive, even though it be necessary to restrict the steaming capacity of the boiler by the use of fine netting and other obstructions to draft to meet this demand.

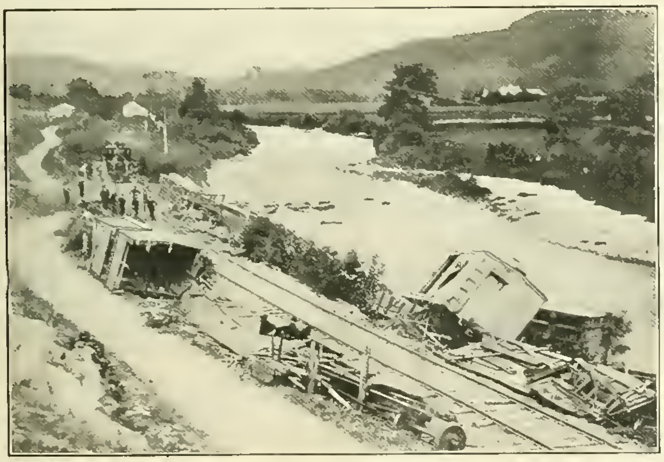
There is usually too much inportance attached to the influence of the deflecting plate on the steaming of an engine. Of course its position governs the action of the draft in a measure, but within narrow limits, and its position is easily determined.

To best understand its influence, we will assume, first, that the engine has the extension front without the deflecting plate. Here we have a practically free draft, and other things favorable, the engine would steam freely until the front end filled up. Now beginning at the top, we will start our plate and note the effect as it grows, so to speak, down to the proper position. When it covers three or four rows of flues there is no evident change, but after passing the center of the boiler we find that at some point it allows only such an amount of sparks to accumulate as will not hinder the draft, and when that position of plate is reached, it effects a balance of those two conditions, namely, the steaming of the engine and the cleaning of the front end, that is the proper position for it. Should the engine steam hard at some later time, rest assured that no alteration in the adjustment of the plate will help her; the defect should be sought elsewhere. It is no fault that an engine fills the front end half full if she steams, as they frequently do. To lower the plate in that case might have the effect of keeping the smokebox free of cinders; but if it caused engine to steam hard, might better be let alone. If the front end be kept airtight, a certain quantity of cinders in it can do no harm. If it leaks below the cinder line, the air admitted, coming in contact with the cinders containing much unburnt carbon, will, at the high temperature in the front end, produce combustion, with damaging effect. The front end is kept cleaner by lowering the plate, or apron on it, because of the whole draft force being restricted in its passage from the firebox to front end through the small space uncovered by the plate, producing a violent action that drives the sparks against the netting with such force as to break them fine enough for the greater portion to pass through it. When the space uncovered by the plate is of small area, the rush of air to supply the vacuum produced in front end, being supplied through the most convenient passages, which are in the forward end of firebox, the force is often sufficient to lift the fire off the grates at that point. The tendency to lift the fire under these conditions may be somewhat reduced by the use of the back damper, as the air to supply the vacuum in firebox, rushing in at the nearest point, forces its way through fire at rear of firebox, but, being farther from the source of draft than in the other case, causes less agitation of the fire, rather tending to equalize the circulation of air through it.

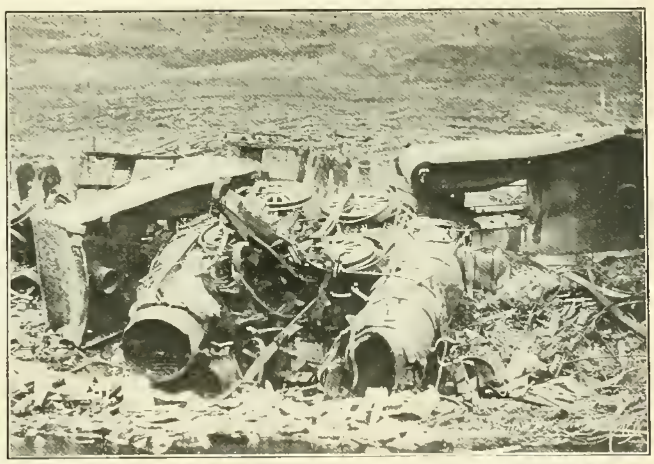
Raising the plate tends to increase the circulation through rear of firebox; but in raising it, due regard must be had for the liability of the front end to fill.

It is best to run the plate high as possible for other reasons that very materially concern the efficiency of the boiler. When the circulation is strongest at the rear half of firebox, the greatest amount of coal is burned there, enabling a man of ordinary skill to fire the engine successfully, the circulation takes a more vertical course through the fire, tending to lift it, or producing a similar action to that gained by the use of the diamond stack, and the firebox heating surface is fully utilized. When the plate or apron is set too low, there is an absence of that almost uniform vacuum in firebox, with its beneficial results, instead of which a direct diagonal current of air is produced, and, if violent enough, drags the fire towards the flue sheet instead of lifting it vertically, utilizing the firebox heating surface only partially, because the flame is also carried by this diagonal circulation direct to the lower flues without coming in contact with the crown sheet, as is the case when the circulation has a more upward tendency.

But no adjustment of the deflecting plate will correct the prevailing error to which may be attributed the cause of the majority of poor steamers, which is, the



TRACK JUST CLEARED.



A DEATH GRAPPLE.

setting of the nozzle. If perfectly plumb and in line with the stack, it is an easy matter to regulate the draft; if not, it is impossible to do so. The maximum draft force consistent with the power of the engine must first be obtained before any attempt at regulating it is made. A little insight into the philosophy of artificial draft as produced in the locomotive will aid our understanding of the point just referred to. The first exhaust at starting must displace the air contained in the stack. The resistance of this inert body of air causes the exhaust steam to spread so as to pass out through the stack in the form of a piston, expelling the air above it. Should the engine continue to work slowly, this piston-like action continues, the air circulating through the fire passing out through stack between the exhausts or steam pistons. If the speed increase, the interval as well as the space between the exhausts decreases, while the volume of air circulating is greater. Now, as the steam and air, together with the smoke and unconsumed gases must all pass out through the stack together, it is reasonable to suppose that there is a point at which, owing to the increased volume of and the influence of the several factors upon each other, the action of the draft is changed to a more continuous circulation, such as is produced by a blower; for when the exhausts would follow each other in such rapid succession as to leave little or no interval between them, the space for the other factors to pass out would be least, just when their volume would be greatest. Under this condition the exhaust passes out through center of stack, accelerating, by contact with the air and unconsumed products of combustion which surround it. When the proportions and adjustment of parts are such as to effect the most consistent combination of volume and velocity of circulation through the stack, then the highest efficiency is gained. In the very wide stack the circulation would be sluggish; in the narrow one, too much restricted. That the same sizes may be seen on engines differing greatly in size of other parts, does not by any means prove the insignificance of stack proportion.

Passing from the question of diameter to that of height, we find the short stack unfitted for slow service. We are depending for draft in this case chiefly upon the displacement of air by the piston action of the exhaust in the stack; so it may be seen that, with the short stack, the volume of air displaced by each exhaust may not be sufficient to keep up the required circulation through the fire during a long, slow haul.

A stack to suit the ever-varying conditions of any kind of service is of course out of the question, but it seems unwise to disregard the matter of fitness altogether.

The writer is aware of the fact that the modern engine is restricted as to height of stack by the overhead clearance limit, which varies on different roads, but do we not often find the stack lower than the whistle or the headlight? A regard for mere harmony of outline ought to be enough to prevent such disproportion. As already stated, if the nozzle-box be properly set, the nozzle diameter, as well as the position of the deflecting plate, is easily found; if not, no alteration in the diameter of the former, nor the adjustment of the latter, will correct the error.

A too large nozzle produces an inefficient draft. The volume of steam emitted causes an extremely low vacuum, but the discharge is so short and clean that there is a considerable interval of time between the exhausts during a slow, hard pull, and the vacuum produced in front end is in a measure supplied by air from the top of the stack instead of all coming through the fire, as is necessary to get best results, and even when the speed is such as to cause the exhausts to follow each other in quick succession, there is a lack of that velocity of discharge and continuity of action produced by the use of the smaller nozzle, which is so essential to a free-steaming engine.

The small nozzle contributes in another way to the steaming of the engine, by effecting a high back pressure and compression in cylinder, causing the clearance spaces at ends of cylinder to be filled with steam at a higher pressure than would be the case with a larger nozzle, thereby preventing the need of filling these spaces almost wholly with live steam as might otherwise be necessary.

There is no doubt much to be said against the small nozzle on account of its tendency to restrict the power of the engine through the influence of back pressure and compression; but that is "another story." We are discussing only the steaming qualities of the engine in this article; but for the sake of argument we will digress from the line we have followed enough to state that when it comes to a question of engine failures, the number that can be charged to lack of steam is far in excess of that number that fail through restriction of cylinder power, due to small nozzles.

READY FOR THE REPAIR SHOP.

HARD ON THE ENGINE.

Case-Hardening.

The process of case-hardening really consists of two processes. First, the surface of the piece, whatever it may be, and so on to a greater or lesser depth, depending upon the process employed, is changed very definitely from iron to steel; then this surface is hardened as any steel is hardened.

There is surprisingly little difference as between iron and steel—that is, between a bar of good iron and a bar of steel—so far as the constituent parts are concerned; yet this little difference constitutes the important distinction between something that will "cut like a razor" or that may be tied up in a knot, like a whip lash.

The first process in what will always be called case-hardening is the supplying to the iron—the surface of the piece under treatment—what it lacks to make steel of it; otherwise it will not harden. The principal thing to be supplied is carbon, one of the most common of all substances.

Cast iron is made up, generally, of not less than 3 per cent. carbon. For the purpose of converting this into wrought iron an essential part of the process consists of getting rid of the carbon—burning it out.

In the process of converting the wrought iron into steel, some of the carbon must be restored; the wrought iron must be recarbonized. In the first process of case-hardening the surface of the wrought iron is kept in intimate contact with something that will supply the carbon to the iron when the latter is at a fairly high temperature.

For case-hardening superficially—that is, for converting into steel a thin film of the iron only—the operation is all in the open air, which makes it imperfect in every respect. Prussiate of potash is very commonly employed. If the piece is well polished and reasonable care is taken, a fairly fine mottled gray surface is obtained.

When the process is employed for small pieces at frequent intervals the potash may be kept in any suitable iron vessel. The piece to be hardened is dipped into this and stirred about, an old spoon being used to keep it covered with the potash. When the piece cools somewhat it is again heated slowly, the potash adhering to it, and when hot again treated with the potash, then heated as for tempering a piece of steel and plunged into water.

The heating and covering with potash may be repeated three or four times, or more, if a little deeper hardening is desired.

Where case-hardening to a considerable depth is desired the pieces are packed in a suitable iron box or pot, along with equal parts of charcoal, pulverized bone and leather scrap. Or instead of this, saltpeter and leather may be used in the proportion of 1 pound of the former to 8 pounds of the latter.

First, a layer of the mixture is put in the bottom of the box, upon which a layer of the pieces to be case-hardened is carefully placed, so as not to touch one another or the sides of the box. Over this another layer of the mixture is placed; then another layer of the pieces, and so on till the box is filled. The cover is then put on and the joint luted with clay to exclude the air. The box and its contents are then kept at a red heat for from three to five hours longer, according to the depth it is required to harden. It is then uncovered and the contents dumped into a tank of clean, cold water, with the least possible exposure to the atmosphere.

In this way the hardening may be to a depth of 1-12 inch or deeper, which is necessary for pieces subjected to very considerable wear. This leaves a very hard surface with a soft center, not likely to break by shock.

Large pieces case-hardened in this way are sometimes found to have the metal beyond the hardening weakened in the process—granulated or something of the sort. To remedy this some practice annealing after case-hardening, then heat and cool the same as in tempering steel.

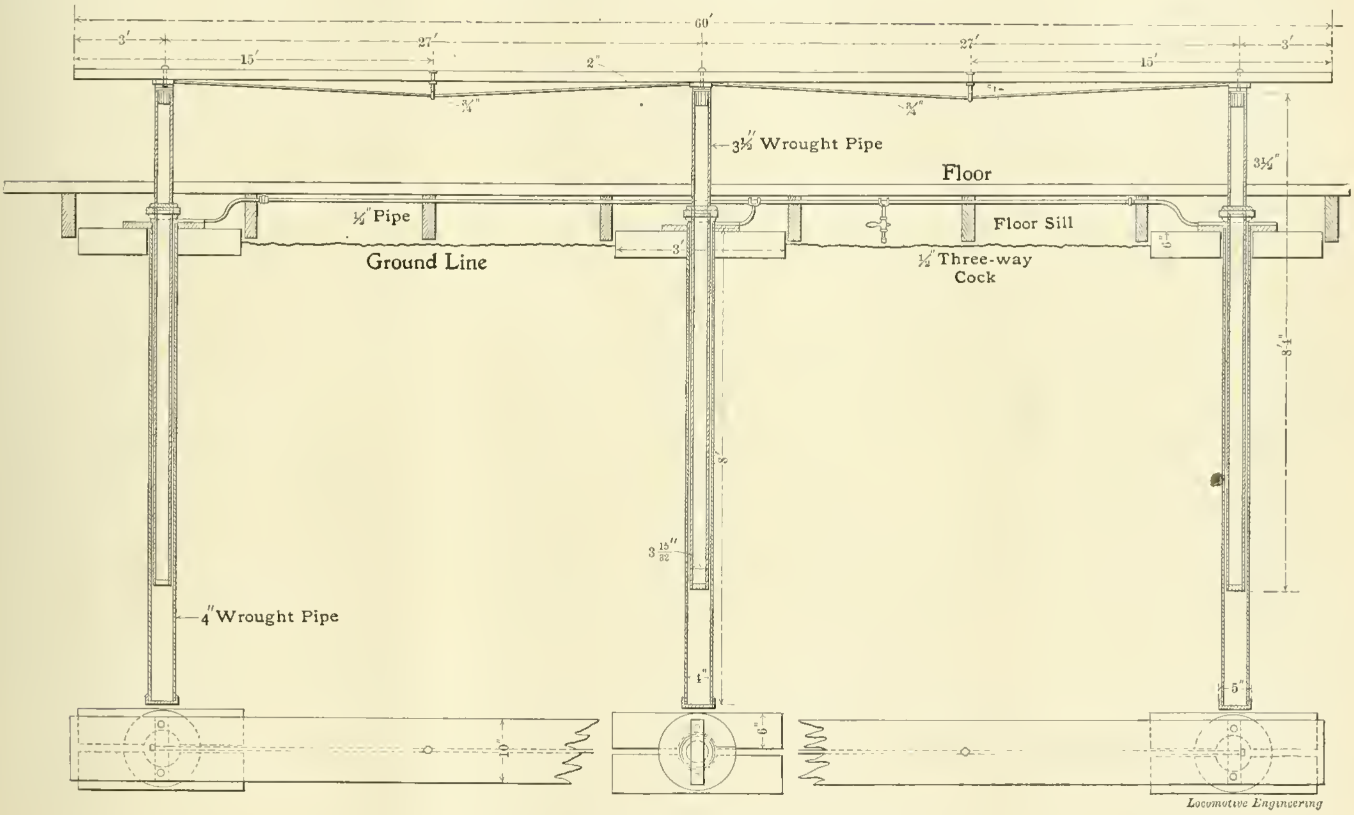
Iron that is to be case-hardened should be homogeneous in quality—that is, not of piled and welded scrap. If this precaution is not observed, the pieces will very likely come out badly sprung out of shape. The quality of the iron should be good.

When a good deal of case-hardening is done, a special furnace is very commonly employed, in which the boxes or pots are placed for heating.

Pneumatic Trestle for Paint Shop.

This is a plan proposed for the Manchester (Va.) paint shop of the Southern Railway. As will be seen, it consists of pipe cylinders and plungers, the latter 3 15-32 inches in diameter. The piping is ½ inch and is beneath the floor. The cylinders are also sunk in the ground, only requiring a 5-inch hole a little over 8 feet deep.

Each trestle is 60 feet long, supported on three plungers, which, with 70 pounds of air will raise about 2,000 pounds, including trestle. The trestle is trussed with ¾-inch rods and 7-inch struts.



CAR PAINTING PLATFORM MOVED BY AIR PRESSURE.

Messrs. Parker & Burton, 12 Hodges Block, Detroit, Mich., have favored us with a copy of an interesting pamphlet on "Gas Engine Design," by E. J. Stoddard. It is one of the best things of the kind we have seen, and is of value to anyone interested in the gas engine and its development. We believe a copy will be sent to any of our readers on request—and it's well worth sending for.

The North American Metalline Company, Long Island City, N. Y., have recently issued a neat catalogue of their metallic bearings, which run without oil. It contains much information about these.

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Electric Traction "Not Entirely Satisfactory" for Elevated Railroads.

The Manhattan Elevated Railway Company, New York, are said to contemplate changing their motive power from steam locomotives to electric motors. From what we have seen of electric motor operating in Chicago and in Brooklyn, we should judge that the Manhattan people are likely to regret making a change to electricity if they should decide to do so. The locomotives that have been so long upon the road have proved as reliable and efficient as any motive power ever applied to the hauling of trains; and we have never seen any statement which indicated that a traffic such as exists on the Sixth Avenue Elevated Railroad could be handled more cheaply than it is done by locomotives. For many years the steam locomotives have transported millions of passengers safely, expeditiously and with no delay worth mentioning. We are safe in affirming that there have been more accidents and vexatious delays on the Brooklyn Elevated in a single year than there have been on the Manhattan Elevated Railroad system in ten years. The public that are served by the elevated railroads of New York are difficult to satisfy and exacting about the service they must have, and there is a constant agitation calling for more rapid transit, but complaints about delays are remarkably rare. If the electric motors should cause delays to New York people such as have been common in Brooklyn, there would be shouts of rage that would hurt those responsible for the change.

But annoying delays are no the most serious drawback to electrically operated elevated railroads. Fires have been very frequent on the Brooklyn elevated railroads caused by the burning out of fuses and other accidents. A fire started in a surface car is not very serious, because the passengers can easily step out, but on an elevated train there is the given alternative of keeping in the car to get burned to death or jumping off to get killed by falling on the street beneath.

The following are a few of the accidents recorded during the first three months of this year:

January 2.—A Brooklyn elevated train, crowded with people returning from Coney Island, gave its passengers an intimation of the dangerous nature of the electric motor. Flames burst suddenly from the floor of one car, creating a panic, of course, among the men, women and children returning from their day's outing. The men, stripping off their heavy overcoats, beat down the flames with their garments and finally extinguished the fire, after forty minutes' delay of the train. Another train, only a half-hour later, on the same road, was delayed by a similar cause—a burnt-out fuse.

January 24.—The unprecedented spectacle of a car consumed on the Fifth Avenue Line of the Brooklyn Elevated System gave passengers and observers a startling object lesson. The crowded car took fire beneath the floor and burned where it stood. The Fire Department turned out to guard the adjacent buildings, endangered by the "accident." In playing on the burning car four of the firemen were stricken insensible by the terrific electric current from the third rail above, the streams from the third rail being perfect conductors. The Brooklyn "Standard Union," chronicling the incident, said: "About two months ago a car was burned at the same station, and about five months ago another car was destroyed while at the St. Marks Avenue Station. The officials of the road are not entirely satisfied with the new system of motive power." It might have added—what was in everybody's thoughts: Electric energy may be the "harnessed lightning," the "thunderbolt tamed," but its potentiality for mischief and destruction makes it a never-asleep enemy to human life, and to property within its reach.

February 2.—A burnt-out fuse and a blockade on the same line. Says one report: "All efforts to insert a new fuse resulted in explosions and showers of sparks and flames that badly scared the trainload of passengers."

February 5.—Two more breakdowns, blockades and a casualty were the record for this day on the Fifth Avenue line. The train being "stalled" by a burnt-out motor box, the passengers footed it along the track to reach the station. One young man touched the center or charged rail, when the heavy current shocked him and threw him on the street underneath, a fall of 18 feet.

All through February these "stalls" were so frequent that business men, in great numbers, in order to get to their offices beyond the bridge, used the surface cars. The month's casualties wound up by the dreadful burning, on the night of the 27th, of the operator at the switchboard at Third avenue and First street, Brooklyn. The blowing out of a fuse at the board crossed the wires, when the operator was enveloped in flames which burned every bit of clothing on his body.

March 21.—Another "spectacular" exhibit of a burning car, and a wild scramble of passengers over the trestles to the station at St. Marks avenue, on the same Fifth Avenue line. Likewise "spectacular" the "accident" of a half-dozen firemen, playing on the flames from the street beneath, being knocked prostrate by the "electric energy" from the much-alive third rail above them.

Mechanical Firing.

There is considerable discussion among locomotive men in regard to the matter of placing two firemen on the very large locomotives now built. These engines burn more coal than one man can handle and skilfully place it in the firebox where it will do the most good; if it is not fired skilfully the best results are not obtained and the engine does not steam.

It takes fuel to produce power; the power of the engines has steadily increased of late and with it the coal consumption, till the large engines consume more coal than one man can handle steadily for a trip. In addition to the increase in power of the engines, most of them have long runs in order to get a satisfactory mileage out of the machines. This is an additional tax on the strength of the fireman.

A superintendent of motive power of a trunk line stated at a railway club meeting some months ago, that the question with them about getting their heavy passenger trains over the road and making up time when delayed was not so much the size of the engine as the ability of the fireman to keep up a supply of steam for the large cylinders at high speed.

Putting two firemen on an engine has been tried on some roads. This does not reduce the labor on the man at work, except that the other man can prepare and pass the coal down after the supply next the coal gate is used up, and take turns at firing. Engines that burn 2 tons of coal per hour are the regular thing, and there are plenty of them in service that burn twice that amount when handling heavy trains at high speed. We know of a class of ten-wheel passenger engines with 10-foot fireboxes located above the frames, so they are as wide as will go between the drivers, which burn about 4 tons per hour when handling trains on a heavy grade on a fast schedule.

Oil fuel would solve this question in one way, as one fireman can regulate the supply of oil fuel for the largest type of engine easily; but the matter of the cost of oil fuel when compared with cheap coal will bar oil out, except for special service. Where steaming capacity and high power are of enough importance to balance the extra cost of oil over coal, it could be used; but the visible amount of fuel oil on hand is not large enough to warrant a very extensive use of it.

We do not see why machinery cannot be called in to handle coal into a firebox in place of manual labor just as well as machinery now does the work that at one time was done by man-power. Take the automatic brake, for instance, that has been advanced from a crude machine for use on short trains to the perfected apparatus we now have that makes possible the high speeds and heavy trains of to-day. With man power it would be impossible to do this work.

Just the same, we can have a machine to do the hard work now required of the fireman's muscles, and only call on him for the skill to operate the machine. Hand work will fall behind and machine work take its place whenever the limit of endurance that hand work can reach is attained. There is a prejudice against a machine that displaces hand work, for fear that it will throw labor out of employment. With a mechanical stoker this would not be the case, as the fireman would still be required just as much as when he handles the scoop.

If there is a demand for such machinery, American inventive genius will soon supply the article. It may be crude at first and need considerable improvement to ensure success, but it can be perfected. If half the inventive genius which has been devoted to automatic car couplers was applied to a mechanical stoker for locomotives, the matter would be well under way now.

There are a number of mechanical stokers used in connection with stationary plants that are fairly successful. A mechanical stoker for a locomotive is not so easily arranged, for it must necessarily be located on the engine deck or front end of tender next the firebox door.

There are one or two devices now being tried which give promise of success. One of these machines has been at work on the Chesapeake & Ohio Railroad long enough to show that mechanical firing is possible, but it has not been in service steadily enough so we can speak advisedly of its work.

Atmospheric Resistance; Its Relation to the Speed of Railway Trains.

The above is the title of an illustrated pamphlet recently published by Frederick W. Adams, the gentleman who has the air-splitting train in use on the Baltimore & Ohio. We have read the pamphlet carefully several times, and we certainly believe that the author knows as much about the different elements that constitute train resistance as any man who has taken the public into his confidence. We have given the subject careful study for years, and the views of the author coincide very closely with all we have learned. The work was prepared to attract attention to inventions designed for the purpose of reducing train resistance, and has something of an advertising character, but that does not detract from the facts stated. The claim is made that designers of railroad cars have not paid sufficient attention to forms that would offer a minimum of atmospheric resistance, which we perfectly agree with; and the assertion is made that with the form of train designed by Mr. Adams a train could be run at a speed of 100 miles an hour with less expenditure of power than is now required to keep up a speed of 50 miles an hour. This we think remains to be proved, and we are very doubtful about the statement being correct. There is no doubt considerable waste of effort through bad forms of cars, but we do not think that the change proposed by Mr. Adams would effect the revolution in train hauling which he thinks it would. The difficulties encountered in hauling fast passenger trains are fairly stated in a paragraph which reads: "The engineer receives the signal to go ahead. He opens the throttle. The locomotive has a brief struggle in overcoming the train's inertia. With hardly another effort the speed is increased to 10 miles an hour. At this point the engineer may pull the throttle back a notch; but it is easy to work up to 20 miles an hour. Then it is that some powerful retarding influence begins to be felt. What is it? Assuming that the run is being made on a straight and level track, there are but three forms of resistance worthy of consideration—wheel, axle and atmospheric friction. There is nothing to prove that the friction of either wheel or axle increases with speed. On the contrary, it is claimed by good authorities, basing their statements on experimental proof, that these two forms of resistance are greater, both absolutely and relatively, at low speeds than at high ones. But at 20 miles an hour something is drawing on the capacity of the locomotive. At 30 miles this 'something' becomes more marked; at 40 miles the engineer 'pulls her out' two or three notches; at 50 miles the stoker is a busy man, and at 60 miles an hour the ponderous locomotive has exhausted every pound of its power in overcoming the resistance of this mysterious 'something.' A hurricane is seemingly sweeping past the train, tugging with a giant's strength against every projecting surface. The train is held as in a vise. The slightest additional increase in speed is made at the cost of prodigious effort. The atmospheric resistance is increasing in proportion with the square of the velocity. This is the solution of the problem."

We do not regard the increase of atmospheric resistance as the solution of what is presented as a momentous problem, and the tests made by nearly all investigators of train resistances indicate that wind resistance does not increase according to the square of the velocity. In experiments on air resistance alone, made by Mr. O. T. Crosby with a high-speed electrically driven car, it was demonstrated that at 20 miles per hour the air resistance per ton was 3 pounds, at 40 miles 5 pounds, at 60 miles 8 pounds and at 80 miles 10½ pounds per ton. In a series of tests made on the locomotive hauling the Empire State Express, it was found that the total train resistance at a speed of 70 miles an hour was 17.6 pounds. The late A. M. Wellington, who was editor of the *Engineering News* when these tests were taken, worked up a graphic diagram from the results, in which he showed that the estimates made by Angus Sinclair on train resistance of the Empire State Express agreed very closely with the finding of Prof. P. H. Dudley, Mr. Stroudley and others.

Now about the "something" which Mr. Adams speaks of as obstructing the work of accelerating a train at higher speeds. We would suggest that the high piston speed of the engine has more to do with it than the increase of wind resistance. In the tests made on the Empire State Express the mean effective cylinder pressure at 37 miles per hour was about 58 pounds and the tractive force was 6,500 pounds; at 72 miles per hour the mean effective pressure was 48 pounds and the tractive power 5,328 pounds. A decrease in draw-bar pull of more than 1,200 pounds, or about 18 per cent., is sufficient to account for the engine making slow progress in forcing up the speed against the various resistances.

In a report made by Mr. H. H. Vreeland, president of the Metropolitan Street Railway of New York, he stated that the company are about to change 23 miles of cable road into underground electric. The principal reason for the change is that it costs 17.99 cents a mile for cable working and 12.99 cents for electricity. Horse traction costs 19.43 cents per mile.

Train Resistance.

One of the elements of train resistance due to atmospheric conditions is the excess of flange friction caused by a strong side wind striking the train and crowding it over against the other rail. All enginemen know that a quartering wind which catches the corner of each car causes more delay than a head wind of the same velocity, probably because in addition to the head-on resistance which acts on each car, it gives a resistance due to flange friction.

We remember seeing a long passenger train running at a high speed over a strip of new steel that had just been laid to replace old rails, which no other train had passed over. There was a living gale blowing from the West. After the train had passed we saw that the head of the east rail showed the same marks where the wheel flanges had ground against it as are shown on the outside rail of a sharp curve. At no place on the new strip of steel—about one-half mile long—did the west rail show that any flanges had rubbed against it. This proved that the side wind had sufficient power to hold the train over and prevent the wheel flanges striking the west rail, which, under ordinary circumstances, would have taken place, as there is sure to be one or more wheels in a train that lead steadily against the rail one way, and other wheels which lead the other, without taking into account the rocking around of the cars due to inequalities in the surfacing of the track.

There is, no doubt, an increase of flange friction due to strong side winds which is very much like the increase of flange friction due to a curve.

Learning by Example or by Experience.

Peculiar ideas of learning to run an engine still exist in some parts of the country, and the results are what we might naturally expect. One road we know of has an iron-clad rule forbidding a fireman to handle an engine at any time. He can watch the engineer and absorb all the knowledge possible through his eyes and ears, but his hands must remain untrained until he passes the boundary line between the left and right side of the cab.

This rule was probably the result of some fireman being allowed to handle an engine under injudicious circumstances and with disastrous consequences. Instead of inquiring into and settling this particular case, a sweeping order was probably issued, as is too often done.

It seems considerably like learning to swim without going nearer the water than is absolutely necessary to watch the other fellow and listen to his explanations of how he does it. There are many places where it is perfectly safe to let the fireman handle the engine under the eye of the engineer, and it is but natural that a fireman who is so trained will do better running than the man who has simply watched the engineer. As these assumptions are borne out in practice, it seems about time to modify the rules so as to allow proper training for the fireman, and there is little doubt that much damage will be avoided.

Reduce the Weight of the Valve Gear.

There is steady complaint that some of the large passenger engines will not do as much work in proportion to their size as the small ones used to. Just how much of this complaint is founded on facts and how much is notional we will not discuss. A large locomotive, with a supply of fuel and water weighs a good many tons more than the small one, and this load has to be moved just the same as if it was in the cars. Internal friction and resistance have something to do with the question; in this connection should be taken into consideration the excessive weight of some of the steam valves and connections. All this weight must be started and stopped twice in each revolution of the drivers. Starting all these reciprocating parts, bringing them to a stop and starting them the other way takes lots of power.

We would like to see the dead weight of these parts, especially that of the valve, brought down to a safe limit for strength, and then have noted the effect on power consumed as well as the steam distribution.

Credit for Inventions.

A good instance of the way in which we overlook the real inventor and give the whole credit to one man is that of the revolving turret on the modern battleship. This is credited to Ericsson by nearly everyone, and yet he never claimed it, knowing it was the invention of Dr. Theodore B. Timby and that a caveat was filed by him in 1843. But the designer of the whole machine got the credit, and Dr. Timby got none, although he did receive a royalty of $5,000 on each of the turrets built by Ericsson.

There are many other cases in all lines of work, notably the crediting of Stephenson as the father of the locomotive and as the inventor of the link motion—both erroneous and probably not sanctioned by Stephenson himself. Richard Trevithick was undoubtedly the father of the locomotive and James and Howe both invented the link motion at separate times.

Coming down to later days, we have the wide firebox credited to Wootten, when it was really designed years before by the brilliant Zerah Colburn, and the compound locomotive, credited to various designers, when Craddock, in 1848, and Nicholson, in 1850, both had engines in operation.

These claims are not as often made by the men themselves as by their enthusiastic friends, and it is pleasing to note that, with few exceptions, they are perfectly willing to accord full credit to their predecessors. Nor are they to be blamed if people insist on naming certain devices after them whether they wish it or not.

Length of Boiler Tubes.

A topical discussion on the proper length of boiler tubes was engaged in at the last meeting of the Master Mechanics' Association, which is likely to exercise considerable influence on locomotive construction. For some reason the designers of locomotives have settled down to the practice of making the boiler tubes about 12 to 14 feet long. In the discussion referred to Mr. S. M. Vauclain intimated that the tendency to-day is decidedly towards increasing the length of tubes, and lengths of from 15 to 17 feet are now becoming common. He predicted that tubes 20 feet long would come to be used in the near future. The only objection to a long tube was that it was more liable to stop up than a short tube. The difference is, however, not great, and the advantage of the fuel gases imparting more heat to the water is so decided that longer tubes are certain to come.

The Question of Gage.

With the increasing size of locomotives comes the thought that it might have been better if the old 6-foot gage had prevailed instead of the narrower one which was adopted, and there have been many predictions that we should return to it in the not very distant future. As usual, there are at least two sides to the question.

There are places, no doubt, where a 6-foot gage road would be more economical to operate, owing to the increased tonnage hauled in a single train, but when we consider all the railroads of the country, these are few and far between.

Knowing (as was proved before the broad gage was abandoned) that the cost of operation would be increased, to say nothing of the expense of changing, it is evident that many small roads could not be operated owing to this increase, and it is futile to urge it except in a few special cases. And these few must be so situated as to merely haul between terminals, as the cars could not interchange with standard gage cars.

It seems that the proposed change has disadvantages which are serious except in a few rare instances.

Something in This Name.

The name of James Watt recalls many incidents in the infancy of steam engineering, and now it is celebrated in another quarter.

According to dispatches from Tien-Tsin, the hero of the place is another James Watt, also an Englishman, who, with three Cossacks, rode to Taku for reinforcements. They had to force their way through several hostile villages under fire, and their peace of mind was probably not improved by the certain knowledge that an accident to a horse meant death to its rider. There's another James Watt to remember.

BOOK NOTICES.

"Horseless Vehicles, Automobiles and Motor Cycles." By Gardner D. Hiscox. Published by Norman W. Henley, New York. Price, $3.

This illustrates and describes about all the automobiles yet built, and in a general way shows the peculiarities of the different ones. It can be compared to a combined catalogue of all the makers, and, as such, has a variety of engravings, good, bad and indifferent. This is a mistake too many make, as the appearance of a book with uniformly good cuts is, we believe, enough better to pay for the expense.

"Gas Engine Construction." By Henry V. A. Parsell and Arthur J. Weed. Published by Norman W. Henley, New York. Price, $2.50.

This book has been written for amateurs and others who wish to build a small gas engine, and forms a very complete guide for such a case. There are directions for making patterns and details of all the mechanical operations, which are illustrated by photographs taken while building the engine described. The theory of the gas engine is lightly touched, and altogether it seems to be a very desirable book for those interested in this kind of work.

"The Gas-Engine Handbook." By E. W. Roberst, M. E. Published by the Gas Engine Publishing Company, Cincinnati, Ohio. Cloth, $1; leather, $1.25.

This little book is just what many have been waiting for, giving as it does the principles of the gas engine, the practical operation and the possible defects or failures, with cause and remedy. In addition to this, it deals with gas-engine design, gives dimensions and formulas for calculating them and has a chapter on their application to automobile work. The reliability of the data is proved by the name of the author, who was formerly with the International Correspondence Schools in this same line of work. We have no hesitation in saying it is the best book on the subject we have seen.

The *Journal des Transports,* of Paris, in dwelling on the transportation exhibits at the fair, says that about sixty locomotives, most of which are very large machines, and more than 200 cars of various kinds are shown at Vincennes, the international station of transportation exhibits. There are seventeen French locomotives on exhibition. Austria has seven. Germany has six locomotives and "splendid carriages which are real revolutions in the science of locomotion." Five superb carriages from Russia demand unusual attention by their magnificence of material and finish—an "undeniable evidence of an astounding industrial progress." The exhibition is declared to be a triumph of the compound locomotive and the American car. Germany has taken a daring step forward and exhibits a triple-expansion locomotive.

Two Ways of Making Records.

"There are different ways of making records," remarked Joe Brewster, as he looked over the month's performance sheets and found that Billy Bagley was ahead in the "Miles per pint of oil" column.

"What's wrong now, Brewster," asked Bagley, who was sitting in the office, entertaining the M. M. with ideas of his own importance; for Bagley was one of these smooth individuals who play on a man's weakness to advance his own interest.

The master mechanic was a fair sort of man, with a love for flattery that often got him into trouble, and Bagley was just the man who could make him think he ought to be general manager of the largest line in the country.

Brewster was a quiet chap, a good runner, but not a favorite with the master mechanic, because he didn't jolly him into needing a larger hat than nature intended. But the boys all swore by Brewster, because he was square in every way and would help a fellow out of trouble any time he could. Bagley wasn't built that way.

Brewster walked out without replying, and Bagley remarked to the M. M. that he guessed "Joe was sore because he wasn't on top in the oil record."

Now, the M. M. was a sensitive little chap, and immediately grasped the brilliant idea that Brewster had accused him of unfairness in the report. So he called Joe into the office and wanted to know what he meant, and he found out in a hurry.

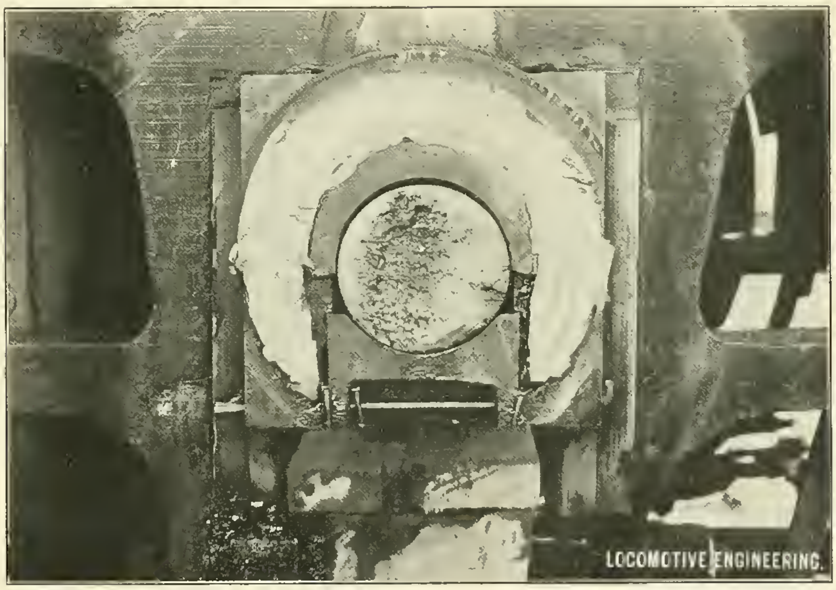
"Well, it's like this, Mr. Smith," he went on. "Jim Burns and I run the '1013,' and Bagley is third man, in between us. Either Burns or I have to report on the engine's repairs; Bagley don't. Repairs are charged against the engine, and reflect mostly on us."

"But what about oil? You have an equal chance on that," growled Smith.

"I'm coming to that. We ought to, and we would if the third man was 'white,' but he isn't, and never was. He's only good for giving taffy (here Smith winced and frowned) and playing cute tricks to advance himself at the expense of others.

"Just compare our oil record before Bagley ran third man between us, and you'll find it is all right and all three men about the same. Now Bagley comes along and plays smart by 'starving' the bearings every third run. He knows they won't heat enough to show while he is on her, but that the trouble will come on Burns and me. We have to use more oil to keep her cool and get her down ready for Bagley to heat up again, so he can save oil. That's his way of making a record. If you think it pays the company to save oil this way, you might issue a bulletin telling the 'third' men to use only half the oil the rest do."

But the M. M. had his eyes opened, and now Bagley and the men with very high records are watched more closely than the others. It doesn't pay to make records that way.



HOW A BROKEN AXLE IS BLOCKED UP ON THE NEW ORLEANS & NORTH EASTERN RAILROAD.

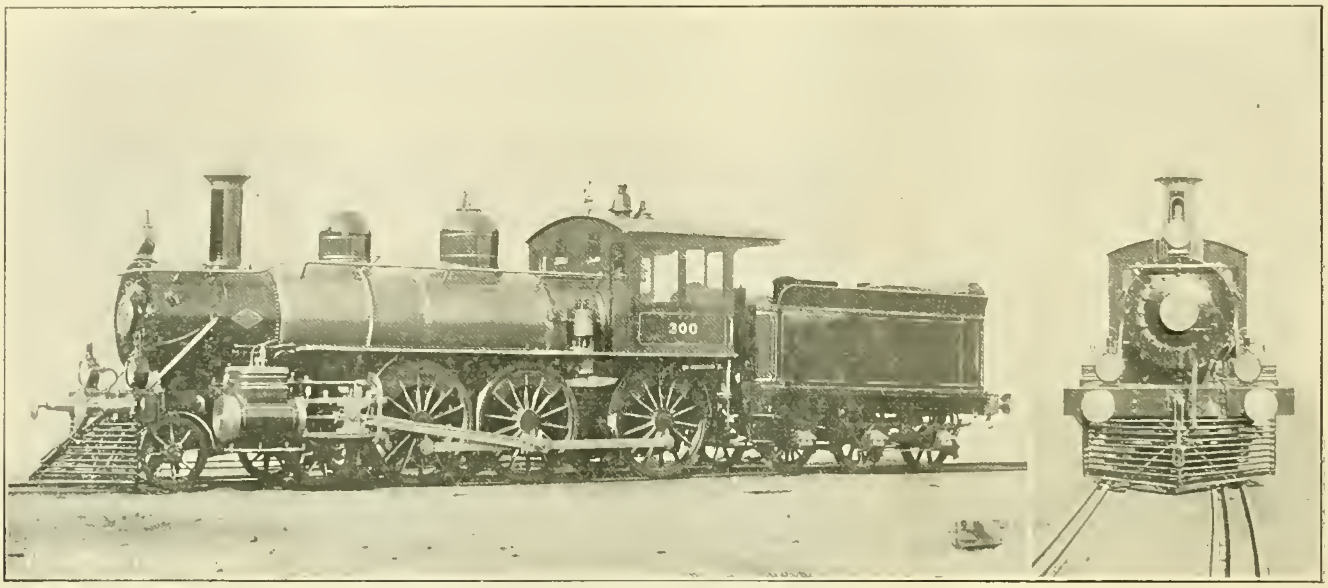
The entire force of clerks and stenographers in the Chicago office of the Railway Department of the International Correspondence Schools attended the ball given to the delegates and visiting members of the Brotherhood of Locomotive Engineers' convention at Milwaukee, May 17th, at the expense of Manager Mitchell. There was a large attendance from other cities, so the ball was a means of bringing together the visitors and delegates and the people of Milwaukee.

Richmond Locomotive for Finland.

This is one of ten 16 x 24-inch engines built for the Finland State Railways by the Richmond Locomotive Works. The standard gage for Finland is 5 feet, the same as for Russia.

The engines weigh 90,000 pounds, of which 65,000 is on drivers. The wheels are 62 inches and have cast-steel centers. Boiler pressure is 180 pounds, which, with a diameter of 52 inches, only requires a ½-inch sheet. Firebox and staybolts are copper, excepting crown stays, which are iron. The tank carries 2,100 gallons of water, 5 tons of coal and weighs 27,000 pounds empty.

American balanced valves and United States metallic packing, Latowski's steam bell, Pintsch gas, Westinghouse European air brake, Dewrance water gages and Sirius injectors were used on these engines.



RICHMOND LOCOMOTIVE FOR FINLAND.

Machine Tools in the Mechanic Arts.

When Dr. Coleman Sellers delivers an address you can always be sure it is well worth reading, and this one, which was delivered before the Franklin Institute, is no exception. We regret not being able to reproduce more of it:

The greatest advance in mechanics has been manifested since the advent of the locomotive. It so happens that the birth of the modern railroad system is coincident with the writer's own birth. At that time the first railroad was put into operation in Great Britain, which development, taken in connection with the advent of the steamboat which preceded it, was certainly an exciting cause of the great industrial advance that has since been made. Previous to 1827 wooden rails had been laid to form roads over which ore was hauled from the mines, and coal was transported in the same manner by animal traction to better advantage than over common roads. The idea of the high-pressure steam engine had been conceived, and, with the full understanding of its value, a practical traction engine for common roads was one of the first examples of its application. It was after the invention of the road engine that the locomotive upon rails became possible.

The important relation which tools and implements bear to the mechanic arts, and, in fact, to all arts and crafts, forms the subject of an interesting tradition depicted in a painting by Schusselle representing a blacksmith seated at the right hand of King Solomon's throne in his great temple, to illustrate an event during the feast given in Jerusalem at the completion of the edifice. To this feast had been bidden the various artisans who had been engaged upon the construction and decoration of the building, those who had helped to shape the gold and silver and carve the ivory and weave the costly hangings that decorated its walls. There also came, unbidden and unrecognized, the swarthy smith, who, forcing his way through the courtiers and the guard to the throne of the king, claimed recognition as the one man to whom was due the creation of the entire work, for it was he who had forged the tools without which the other artisans could have done nothing. The wise king, recognizing the justice of the claim, gave to the smith the seat of honor.

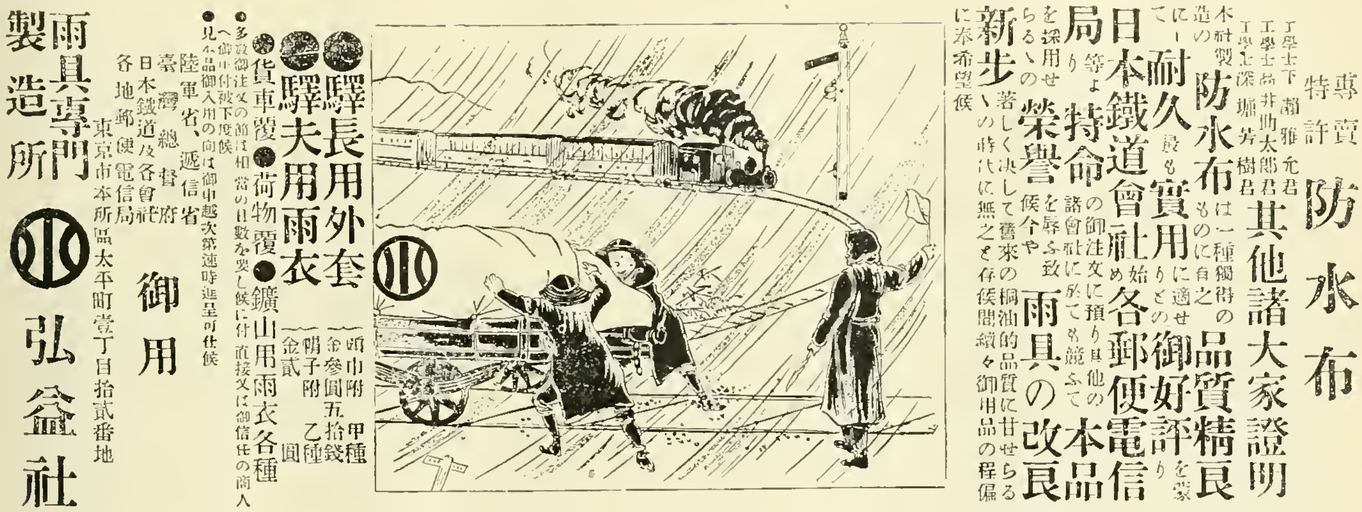
Early in the fifties the writer entered the locomotive works of Niles & Co., of Cincinnati, as foreman, and in 1857 accepted service as chief engineer for William Sellers & Co., of Philadelphia, then, as now, engaged in building machine tools. Thirty years' active experience in machine tool building enables him to speak from a full knowledge of this industry and what machine tools have done for the advance of the mechanic arts. When engaged in locomotive building in Cincinnati, the writer introduced a number of improved methods, but was hampered continually for the want of machine tools powerful enough to do the work as he desired it done, as well as for the want of special tools not then available. At that time in the Eastern cities of the United States certain machine tools were being built with success, and were doing far better work than it was then possible with tools built in a branch of the locomotive works where the writer was engaged. The firm of Niles & Co. had, however, some reputation even then as builders of machine tools and sugar machinery, but it was not until the retirement of the original founders of the house that the works became devoted wholly to the machine-tool business. At the time mentioned, slotters, horizontal boring machines and lathes of various kinds and quality were built in America after the introduction of the planing machine, the first one of which was probably introduced into the city of Philadelphia some time about 1830.

Great Britain produced the first good machine tools, and set the example which has tended to simplicity in design. To that country we owe much that is valuable, not only in the direction of self-acting machine tools, but also in the various appliances for improving the character and quality of work to be accomplished. Thus, Sir Joseph Whitworth, one of the earliest makers of superior machine tools in England, aimed at utility and not ornamentation in the improvement of his products. It was he who introduced surface plates for producing other plane surfaces by means of the scraper; that is to say, after a surface had been made comparatively true on the planing machine, it had yet to be brought to a commercially true plane by a process of scraping off the higher projections, until, when tested by one of the Whitworth surface plates, it seemed to touch at intervals of not more than ¼ inch.

When the early locomotives were built,

in the Niles Works, in 1856, the boring of the cylinders was done on a 36-inch lathe with a horizontal boring bar, and without any knowledge as to the theory of boring in order to produce the best results. It always took two days to bore the cylinder of a locomotive of the size in use at that time, and the largest cylinders were not over 15 inches in diameter. In Philadelphia, when Baldwin's had advanced to a very large establishment, they still bored the locomotive cylinders in the same way. It was not until shortly before the Centennial Exhibition of 1876 that attention was turned towards the utilization of a theory that had come into limited practice some years before as to the improvement in boring metals, the idea being that the quickest and best work can be done in boring by making the roughing cut with a fine feed, removing as much metal as possible by depth of cut, and making the finishing cut with a very broad feed but light cut that would let the cutter pass through the hole to be bored as quickly as possible, so as not to wear the cutting edge in passage. That principle was first introduced when Mr. Asa Whitney, of Philadelphia, discovered that chilled cast-iron car wheels could be made to compete with the best wrought-iron ones and do a greater mileage. If the wheels cast in an iron mold were not allowed to cool naturally, but, taken red hot from the chill, were put into the annealing furnaces and brought up to a heat a little below the melting point, and then allowed slowly to cool, they were found to be free from all internal strains, while wheels taken red hot from the mold would burst into three or four pieces in cooling, showing that there was violent internal strain in metal cast in that way under the tension of the heavy chill on the outside of the tread of the rim. The problem of boring chilled wheels was solved by taking advantage of the fine roughing cut and coarse finishing feed. Mr. Whitney desired to have wheels made interchangeable in their fit on the standard axles, so that when a wheel was fitted on an axle at a workshop in Philadelphia, another wheel could be furnished to fit that same axle at any future time, and just as well as the first one.

When the late Mr. Hudson had charge of the Rogers Locomotive Works, at Paterson, N. J., he applied to the firm of William Sellers & Co. to have a special locomotive cylinder boring machine designed and built, saying that he had seen a boring machine designed by Mr. Grant, of the Grant Locomotive Works, capable of boring a 19-inch cylinder in nine hours. The matter was referred to the writer, and when he came to calculate the theoretical time required for boring a cylinder of the size named, on the supposition that the speed of 16 feet per minute might be used in making the cuts, with a fine feed and a deep cut for the roughing cut, and a shallow cut and a much wider feed for the finishing cut, it was found that the estimated time amounted in all to only three hours, and three and a half hours were named as not only possible, but what might be guaranteed as the productive output of such a machine. An order was given for this machine, it being understood that it was not only to bore the cylinders, but to counterbore the ends for the clearance of the piston, to cut off the sinking head and face up the flanges at each end of the cylinder. When completed, the first test was made with a 19-inch cylinder of hard, close metal. This was bored in three hours and twenty minutes, exclusive of the time of setting the cylinder, which was not much, on account of the peculiar arrangement of the machine and the facility with which the cylinder could be put in place for boring. In this case the cylinder stood still, while the boring bar traveled lengthwise, carrying the cutter head with it, and upon the two face plates of the driving heads of the machine were arranged automatic slide rests that faced off the flanges. In this design there was no guesswork, as the principle of fine feed and deep cut on roughing, with very coarse feed and shallow cut for finishing, was in common use in all operations of boring, turning and planing metals, with exact knowledge as to what result was obtainable when the possible speed of cut per minute had been predetermined for the hardness of the metal to be tooled.



AN INTERESTING STORY FROM THE "RAILWAY TIMES," OF TOKIO, JAPAN. READ IT.

Bell Ringers.

With the ordinary globe valve it is a hard matter to regulate the supply of air or steam so the bell will ring and not turn clear over. When once adjusted after many trials, the first time the supply is shut off to stop the bell ringing the adjusting process has to be gone over again. With high steam or air pressure it is worse than with moderate pressures.

Now if there are *two* globe valves in the supply pipe, one handy to get at and one not so handy, the last mentioned valve can be regulated down fine to handle the bell properly. This valve can be let alone and the handy one opened and shut when necessary to start or stop the bell.

A blind gasket of copper in a union coupling, close to the bell, with a small hole punched in it, works first rate, as it allows air to pass into the bell-ringer and start it, but it cannot feed fast enough to turn the bell over.

Steel Cabs and Fire.

In the recent disastrous fire by which the Southern Pacific lost its roundhouse at Bakersfield and twelve locomotives, the durability of steel cabs was clearly demonstrated. These were designed by Mr. H. J. Small, and, excepting the sash, came out of it in fair shape, it being estimated that one day's work will make most of them good. The wooden cabs, tool and seat boxes and running boards went up in smoke in a hurry.

In spite of the sudden loss of power, only one train was delayed, and that for but twenty-six minutes, which speaks well for the ability of Superintendent Buckwalter and Master Mechanic French, as well as for the co-operation of the men.

A Blizzard Experience.

BY R. E. MARKS.

The first months of 1898 opened with snow and winds in the New England States, and in eastern Massachusetts the ground was white and dreary on the third of February in the little town of Barlow.

Barlow boasted a combination post-office, store and telegraph office, from which the little railroad business of the town was handled. A few scattered houses and a rather pretty ravine, with its very homely railroad bridge, completed the town's attractions, and now that it was snowing again, everyone breathed a sigh of resignation and staid indoors, if possible.

Harold Reed was the telegraph operator, who had been promoted from an even smaller station, on account of his careful attention to duty. But even this hardly satisfied him, for he was an ambitious fellow and wanted to get on in the world. He had two objects in view; one was his determination to advance, and the other—though it perhaps should have been named first—was his dreams of a cottage and a possible Mrs. Reed giving train orders for the regulation of their domestic railway system. For while Reed sometimes mentally opposed the unlimited extension of railways, he was a thorough advocate of matrimonial consolidation.

Deeper and deeper the snow settled over the country, not neglecting to pile up on the track at every possible point, and hour by hour the wind increased in speed, like a fully loaded engine on express schedule.

Trains were being bothered some now, as the snow plow was being kept on the main line, and the branch trains must look out for themselves. With a single-track road this means that even a small station like Barlow is kept busy, and Harold Reed had been on the go all afternoon. The combination telegraph office and grocery was not within a hundred yards of the track, and this meant many a weary tramp in this bad weather.

As night came on, the wind blew harder and the flying snow made it impossible to see more than 50 feet, as anyone who knows these young New England blizzards can testify. Trains were later than ever, and No. 9 had just gone South—two hours and thirteen minutes late. Reed breathed a sigh of relief, and repeated, for the fifth time, the suggestion to his friend at headquarters that a snow plow would be absolutely necessary before morning. Then he started to munch his supper; for he made it a rule never to leave the office during a storm, even if no trains were due.

He had taken his fourth bite of sandwich when the wires began to talk—to almost shout, in fact—and orders came to "hold snow plow bound north till '11' passes at Barlow; couldn't catch '11' at Peters. Hurry."

So they were sending a snow plow at last. He grabbed his hat, threw his coat on as he ran, and, taking his lantern from the hook, started for the track as fast as human legs could carry him against such a storm. Why hadn't they moved the office next to the track, as both he and the man before him had asked for? How many steps would it have saved him today—and it might save a wreck some day! If he could only see the track or his lantern be seen from the cab. He was only half-way now, and the wind grew fiercer every step he took. Suddenly, as the wind changes its direction, the "toooo—too—too" of the snow plow's engine reaches his ears, and before he can run 50 feet farther the plow rolls by without seeing his lantern or hearing his frantic cry.

Back he struggles to his station and calls up Peters, in the vain hope that "11" has not passed, in spite of the message. But this hope was vain indeed. "Left here at 7:13," was the answer. It was now 7:26. Thirteen minutes, and Peters only 7 miles away. They must have met not far from Barlow—perhaps in the cut.

Reed could hardly wait to wire headquarters that he had been unable to stop the plow, before he was off to the nearest house for men and horses.

"Come, boys, help me get out the big sled and get to the cut as fast as we can. God knows what we'll find, but go we must, and it's on me, too."

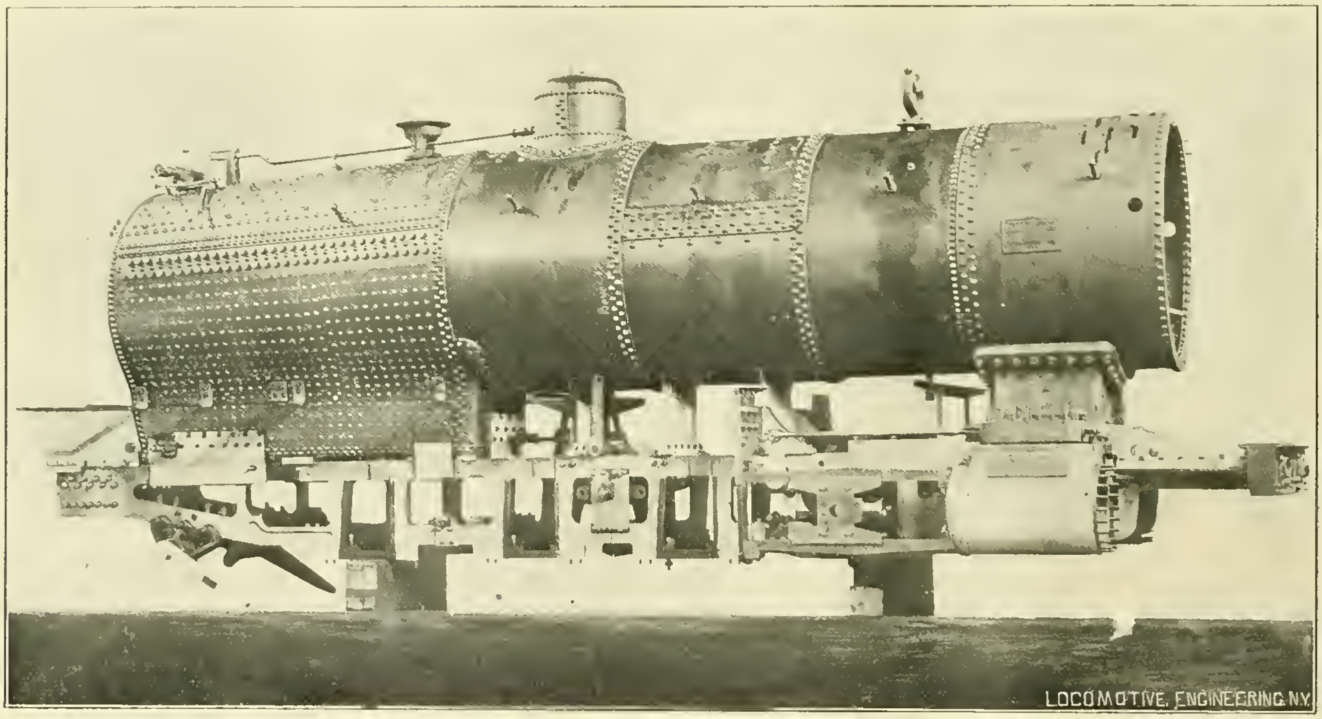
"But it wasn't your fault, Harold—you tried to stop it," said one.

"Yes, and failed. Might as well not have tried, as far as headquarters go. They'll say I didn't go soon enough, and won't believe that the lantern couldn't be seen if it was there. It's different at headquarters, where an operator can drop the red from his desk, and they won't consider what it means to stop a train here."

They drove in silence, the wind cutting from every side, and were at the cut in half an hour. But the wreck was beyond.

"Look, boys," and Reed almost lost himself in frenzy, for there was "11's" engine on top of the plow. "How many left, I wonder," and he sprang from the team and hurried toward it.

Big Tom Johnson, the plow engineer,



BOILER AND FRAME OF LARGEST LOCOMOTIVE IN THE WORLD.

was standing by the wreck, trying to keep warm, and he greeted Reed with a not too cordial "What the devil did you let us by Barlow for? Have any grudge against me, or was it against Ben Tucker?" Tucker was engineer of "11"—the milk train.

"Never mind that now, Johnson. Who's killed and who's hurt? Get them into this sled and we'll get them to the doctor soon as we can. Where are they, Tom? Lord knows, I tried to stop you; but I could not get to the track, after getting the wire, before you'd gone by. I yelled and swung my lantern; but it was no good in that storm. But that's past now, and I'm in for it. Let's get them to town and do what we can now."

"Well, sonny, there ain't none of us dead, and only Burt Carter got caught, anyhow. We saw '11' just before we struck, and jumped. Tucker and Carter wanted to go up in the world, and they stuck by the old girl, landed top of our mill and then they got down. Burt skinned his elbow, punched a hole in his new derby, and bust the suspenders his best gal give him fur Christmas, otherwise—what you doin', Reed?" and he grabbed him just in time to prevent his falling, for Reed had fainted. Overexertion in the storm, and above all the overwhelming anxiety of being responsible for the wreck were too much, and he was the only patient carried back to town.

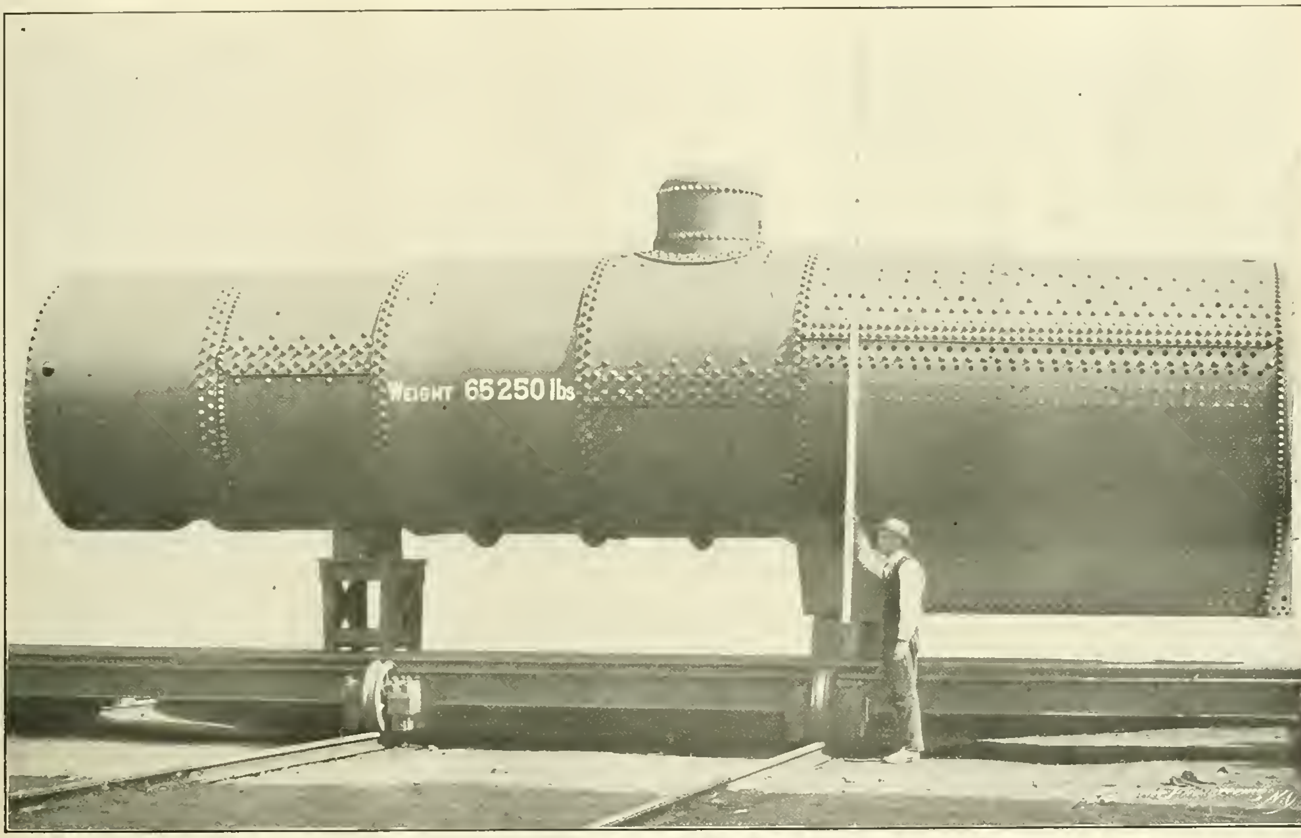
He gave himself up to the constable the next day. The papers attributed the wreck to "negligence on the part of the operator at Barlow," and he was "relieved" from duty; but the engineers told a different story, and the superintendent offered to reinstate him. But he declined, and now runs the store and post-office—minus the telegraph. He refused to rent that corner to the company as soon as he took the store, "to save the next man from any such night as I had," and they now have an office where it belongs—near the track.

. . . . . .

The matrimonial consolidation went through all right—wasn't opposed by the legislature or anybody else, and the young Mrs. R. says she isn't sorry Harold is out of the service—she doesn't like train orders and specials, anyhow. But Reed takes an interest in railroading even yet, and sometimes stops weighing out sugar to hear No. 11 go by.

[Mr. Marks informs us that this is an actual occurrence, and says a picture of the wreck appeared in LOCOMOTIVE ENGINEERING for April, 1898, page 187.—Ed.]

The display of the Pintsch light occupied a very prominent place at the Master Car Builders' and Master Mechanics' convention, in Saratoga, for it was located in the great lobby of the Grand Union. The framework upon which the various styles of Pintsch lamps were suspended was finished in white and gold, backed with heavy plate mirrors. The four styles of lamps shown thereon were all gold-plated and equipped with either cut-glass bowls or bowls of chased glass with empire designs. A novel feature consisted of a dining-car table properly spread with beautiful linen, and holding all the correct table appointments, highly polished silver, pretty tea service and beautiful china. Over this table extended a two-branch silver-plated gas candelabra showing how useful and effective an ornament it would be in dining cars. A white and gold screen afforded a display place for five or six styles of lamps for side illumination, which might be well employed by railroads of this country, where they want novel effects in first-class coaches, parlor and dining cars. Some of the styles shown were a Roman torch design, a three-branch gold-plated candelabra and an Argand bracket lamp.



BOILER OF LARGEST LOCOMOTIVE. NOTE ITS HEIGHT.

Colorado vs. Switzerland—A Comparison.

Switzerland, "the playground of Europe," is visited annually by over 15,000 American tourists and invalids. Why?

While the Alps have isolated peaks such as Mont Blanc (15,781 feet) and the Matterhorn (14,836 feet), the mean elevation of the highest Alpine chain is from only 8,000 to 9,000 feet. Colorado possesses more than 120 peaks over 13,500 feet in altitude, of which no fewer than thirty-five peaks range from 14,000 feet upward. In the whole of Europe there are not over twelve mountain peaks of note.

The highest village in Europe is Avers Platz, in Switzerland (7,500 feet); the highest inhabited point in Europe is the Hospice of St. Bernard, in Switzerland (8,200 feet). In Colorado the mining town of Leadville, with 15,000 inhabitants, is 10,200 feet above sea level; other mining camps are still higher, and some gold and silver mines are worked at an altitude of over 12,000 feet.

The highest wagon road in Europe is said to be the Stelvio Road, in Switzerland (9,170 feet). In Colorado the railroads cross the crest of the continent at Fremont Pass (11,328 feet), Marshall Pass (10,852 feet) and Tennessee Pass (10,433). Switzerland does not possess, even in the famous St. Gothard line, any railroad engineering surpassing, if equaling, these. There are wagon roads over numerous passes in Colorado ranging from 12,000 feet upwards, the highest being Mosquito Pass (13,700 feet).

In Switzerland the cog-railroad from Vitznau to the summit of the Rigi Kulm (5,900 feet) has a length of 4½ miles, in which the ascent is 4,072. In Colorado the cog-railroad from Manitou to the summit of Pike's Peak (14,147 feet) has a length of 8¾ miles, in which the ascent is 8,100 feet, or an average of 846 feet per mile, the maximum grade being 1,320 feet.

One class of Switzerland's finest scenery is along the Via Mala, the Schyn Pass and Urnerloch. In Colorado, the Canon of the Arkansas with the Royal Gorge, the Black Canon of the Gunnison, the Canon of the Rio de las Animas, the Canon of the Grand River, and others, are all much longer, quite as grand as and more varied in character than the best passes in Switzerland. The walls of the Canons of the Grand River, the Gunnison and the Arkansas rise to a sheer height of more than 2,000 feet.

As Colorado can be reached by at least one railroad—the Burlington—in one night from either Chicago or St. Louis, it is hard to understand why more Americans do not travel West instead of East in search of health and pleasure.

Ten-Wheel Compound for Chicago Great Western.

In the construction of the ten-wheel compounds for the Chicago Great Western, cast steel has been used in driving wheels, driving boxes, link hangers, reverse shaft, low-pressure piston, rocker shaft, crosshead and engine truck transom. This is one of a lot of ten built by the Rhode Island Locomotive Works (operated by the International Power Company). The main dimensions follow:

Cylinders—22 and 35 x 28 inches.

Weight—On drivers, 120,000 pounds; on truck wheels, 40,000 pounds; total, 160,000 pounds.

Wheel-base, total, of engine—26 feet 11 inches.

Wheel-base, driving wheels—15 feet.

Height of center of boiler above rail—8 feet 8¼ inches.

Height of stack above rail—14 feet 11 inches.

TEN-WHEEL COMPOUND FOR CHICAGO GREAT WESTERN.

Heating surface—Firebox, 183.5 square feet; tubes, 2,430 square feet; total, 2,613.5 square feet.

Grate area—32.9 square feet.

Drivers, diameter—63 inches.

Truck wheels, diameter—30 inches.

Journals, driving axles—9 x 12 inches.

Journals, truck axles—6 x 12 inches.

Main crank pins, coupling—7½ inches diameter by 5¼ inches.

Main crank pins, main rod—6¾ inches diameter by 6 inches long.

Crank pins, front and back—5½ inches diameter by 4 inches long.

Valve travel, maximum—6¼ inches.

Boiler pressure—200 pounds.

Tubes—Number, 275; outside diameter, 2¼ inches; length, 15 feet.

Smokestack, diameter at choke—16 inches.

Truck axle journal, diameter and length—4½ x 8 inches.

Weight, tender—Light, 40,800 pounds; loaded, 107,000 pounds.

Tender, coal capacity—8 tons.

Tender, water capacity—6,000 gallons.

Among the equipment are Nathan lubricator, Leach sander, Richardson balanced valves, Westinghouse-American brake, 9½-inch pump, Sargent brake shoes, Ajax metal bearings.

Breaking Down.

It used to be the custom in case of a breakdown to get the engine disconnected at the proper places to allow the uninjured parts of the engine to bring on the train. This cannot be done nowadays. It delays the main line traffic too much on a busy road. What is needed is to get the disabled engine going as quickly as possible. The main rod connections are so heavy on some engines that the engine crew cannot handle them to take down. What we want now is short methods of getting disabled engines out of the way or bringing in their trains to points where another engine can be had without so much disconnecting.

Boys, let us hear from you about short methods which are safe that you have seen tried and know to be safe.

The class of men in our army is indicated in a measure by the frequent orders we get for books and papers. We have sent a number of Sinclair's "Locomotive Engine Running and Management" to the boys in Cuba, and have a number on our mailing list. A recent example is a letter from William B. Hay, trumpeter, and George F. Webb, of Troop H, Eighth Cavalry, stationed at Ciego de Avila, Cuba. Men of this kind can be trusted to uphold the honor of the country by manly actions in days of peace as well as by valor in time of battle.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Oil Hole in Brake Cylinders Abandoned

The abandonment of the oil hole in the brake cylinder by the Westinghouse Air-Brake Company is a move in the right direction and a material assistance toward the better maintenance of air brakes.

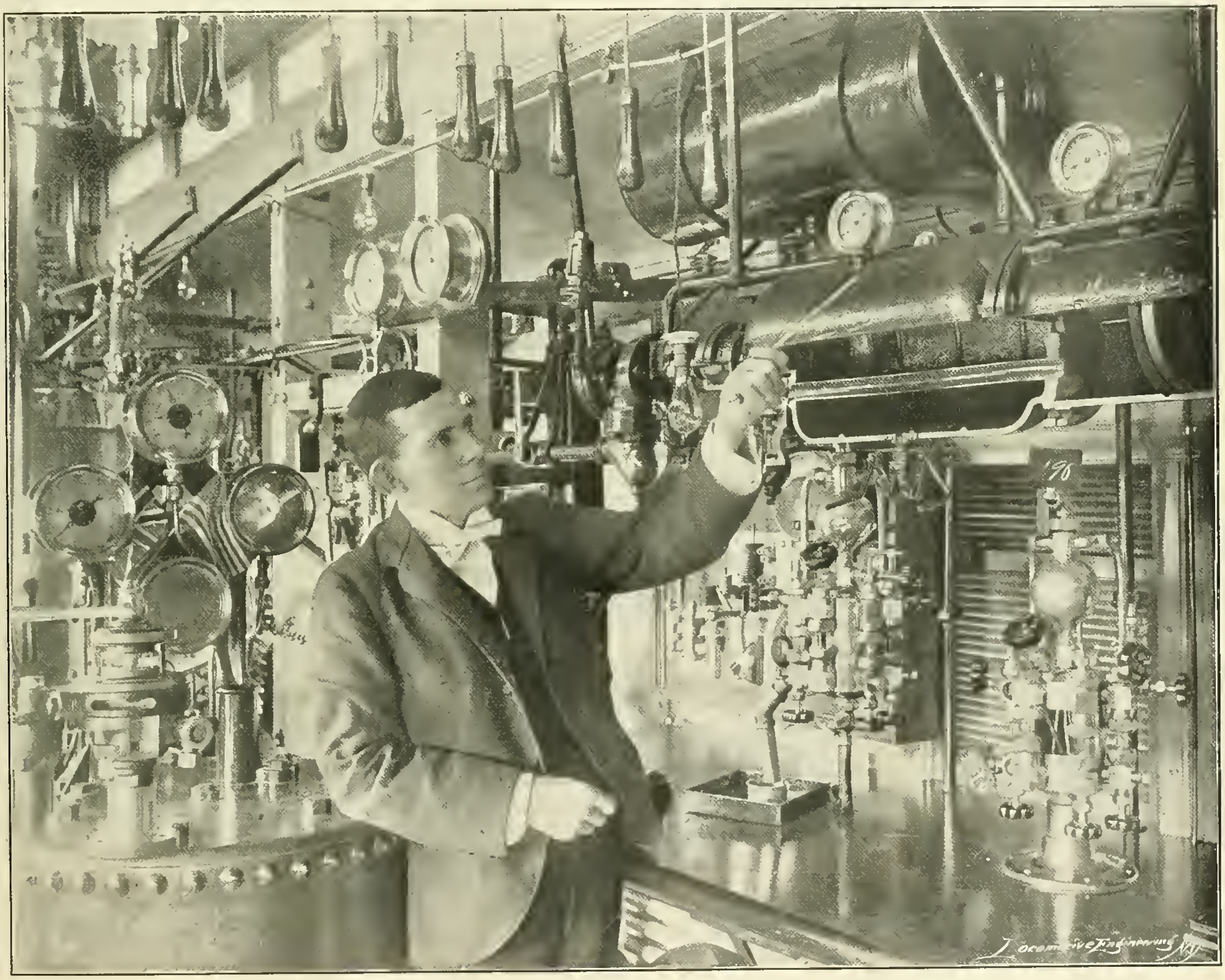
In the early days of the air brake, the oil hole was believed a necessity in order that a lubricant could be easily introduced to the cylinder and leather piston packing, thereby maintaining an air tight joint. Subsequent experience, however, proved this method to be insufficient, and even harmful. The oil seldom reached the top, even though spraying syringes were used, but even then the small amount which reached the top would rapidly gravitate to the bottom and lie there in a pool, or back up into the triple valve, only to flow out in a flood when a cleaner took the parts down. The bottom would be well oiled, but the top would be dry. Then turning the piston was tried; but that did little good, because the oil continued to gravitate to the bottom, leaving the top dry and not air tight.

When the maintenance of air brakes was first agitated, air-brake men began to realize that instead of performing a useful function, the oil hole was really a menace and a drawback. Incompetent and irresponsible inspectors would remove the oil plug, flood the cylinder with oil, and consider that the brake had been repaired. Who ever heard of a dry, parched vegetable garden being benefited by a cloudburst of rain; or a smouldering fire brought to a blaze by smothering it with coal; or, further still, an expiring patient cured by being obliged to gulp down the whole bottle of medicine?

Then again, these same incompetent persons, on to whom the maintenance of the air brake was unloaded, were ever ready to accept the standing invitation of the oil hole to fraudulent practices. A deluge of oil through the hole would be followed by the stencil "Cleaned and oiled." The perpetrator of this outrage not only falsified in recording the work done, but also prevented the perhaps badly needed work being done by some honest and conscientious repairman at another place.

At the inspection points on the Nashville, Chattanooga & St. Louis Railway, where perhaps one of the best systems of air-brake inspection and repairs in the country is kept, record shows a surprising number of air brakes cut out because of triple valve gaskets and emergency valve seats being ruined by oil getting from the brake cylinder into the triple. This is a serious and needless state, and is sufficient in itself to condemn the practice of oiling.

Altogether, the abandonment of the oil hole will be seen to be a wise decision. The



AIR-BRAKE INSTRUCTION CAR ON THE WABASH RAILROAD. INSTRUCTOR ETTINGER EXPLAINING WITH NEW SECTIONAL DEVICES.

brake piston must now be removed in order to apply the lubricating grease, which has proved its better adaptability for the purpose. There will be fewer defective rubber gaskets and emergency valve seats now that oil cannot reach and ruin them. The new lubricating grease will keep the leather packing air-tight. The parts must be removed to be cleaned and lubricated, and the repairmen must learn how to do it. The invitation for fraudulent stenciling will be removed—which will all go toward a better maintenance of air brakes.

Practice Should be Corrected.

We are informed that one of the prominent roads in the Middle East is equipping about a thousand flat cars with air brakes and neglects to put on the pressure retaining valve, which is included in each set of brakes, and is therefore bought and paid for. Should these cars go on a road where pressure retaining valves are needed, that road, according to the Master Car Builders' rules of interchange, has a right to apply the valve and charge it to the owner of the car.

CORRESPONDENCE.

Ingenious Instructing Device.

Editor:

I am sending you two photos of the first and only actual working sectional brake and triple valve complete. This brake is in the Wabash instruction car, and is so located that each member of the class may see all parts.

The sectional working parts include all parts of the brake cylinder, auxiliary reservoir, quick-action triple valve, retaining valve and release valve.

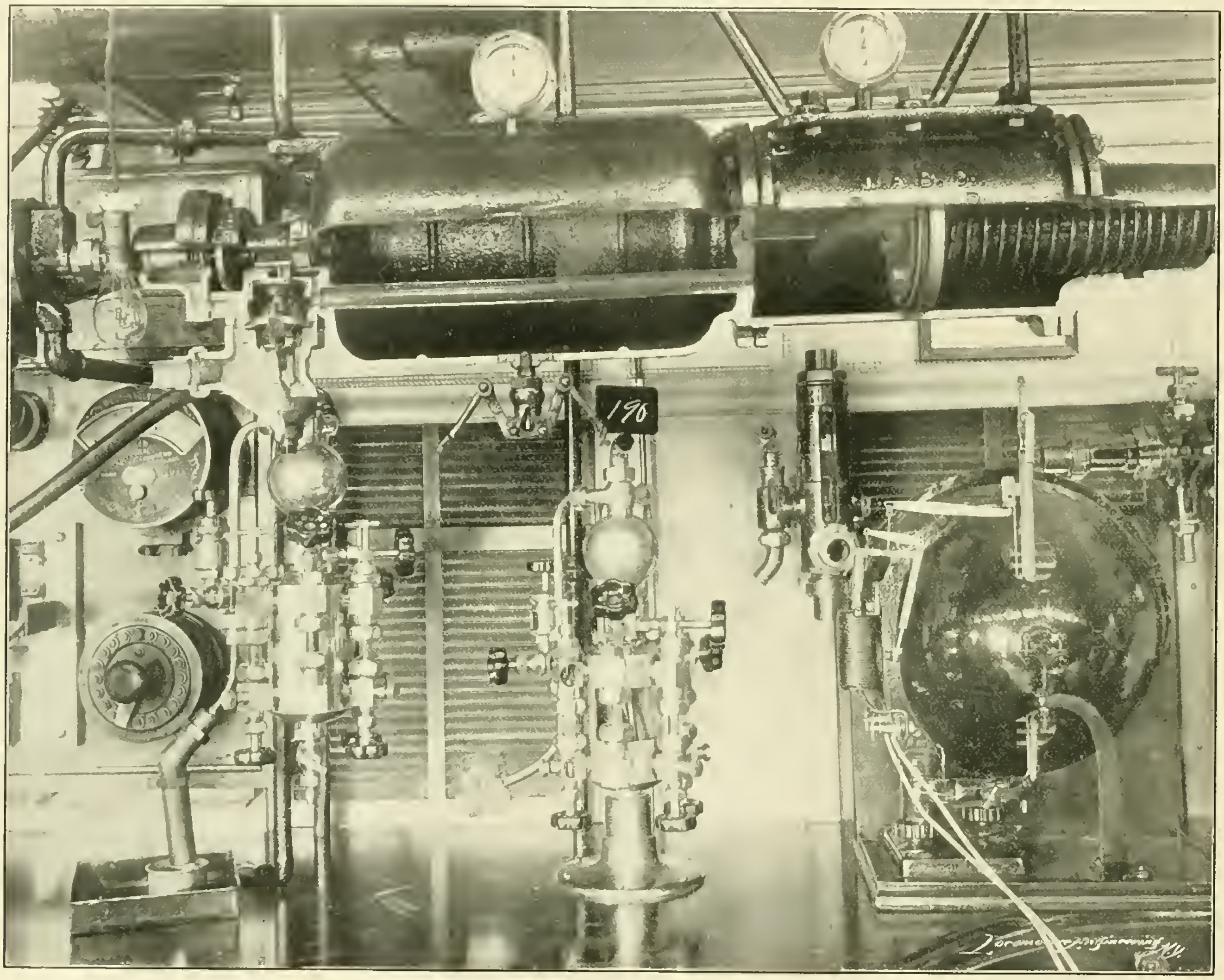
The triple valve movements are obtained from a working triple, connected to it in tandem by the necessary levers and triggers. The piston movement in the brake cylinder is transmitted by levers and rods from a working cylinder, to which is attached a full-size brake gear.

The sectional release valve is piped from the back to the working auxiliary reservoir. The rods, levers and pipe attachments are kept out of sight to such an extent that in looking at the brake from the center of the car the mind is not confused by any attachments foreign to the regular brake.

The lubricators, electric headlight and other parts shown on the table beneath the brake are movable, and can be placed in other parts of the car when necessary.

The expression of Air-Brake Instructor Ettinger would indicate that he is well pleased with the new arrangement of the brake. It will also be noted that all working parts come in the line of vision of persons being instructed.

J. B. Barnes,
Supt. M. P. & M., Wabash R. R.
Springfield, Ill.



INGENIOUS INSTRUCTION DEVICES USED ON THE WABASH RAILROAD.

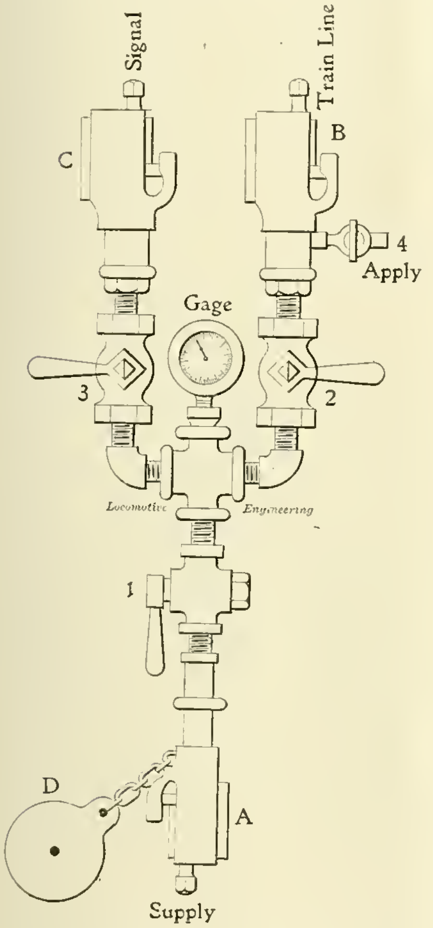
The Lubricator Did it.

Editor:

It is interesting to note the curious actions of the automatic brake at times, and I am one of your readers who is pleased to note that many of your writers are kind enough to give the readers of your paper their findings, and as rather a peculiar case came under my observation the other day, I will submit the same, which may prove of interest to some of your readers.

Engine 1899 was standing on the cinder pit, and, hearing the brakes release several times, wondering who could be amusing themselves with the brake, I walked up to the cab, but found no one near the engine.

I began to investigate, and found a liberal leak in brake pipe pressure sufficient to cause brake to set; but why the brake would continue to release through the triple valve was not so easily determined, as the throttle to air pump was shut off tight and the pressure between brake pipe and main reservoir was equal. However, I noticed there was air taken in



AIR BRAKE AND SIGNAL TESTING DEVICE.

at air inlet of air pump occasionally, which was due to steam intake throttle of lubricator being left open, which allowed steam to pass down through equalizing tube into air pump, causing same to make a stroke occasionally, which increased pressure sufficient to cause triple valve to move to release position.

Owing to the 1-32-inch choke plug in tallow pipe, steam could not pass rapidly to pump, which, after making a stroke, would remain standing, until brake pipe leak would again set the brake, after which it was again released, as above mentioned.

Detroit, Mich. J. B. Odel.

Cylinder and Triple Valve Cleaning on Freight Cars.

Editor:

In response to the desire expressed by Mr. Blackall in his valuable article in the July number, the following additional suggestions are contributed:

Instead of pouring the lubricating oil into the cylinder, introduce and spread it with a swab, thus saving oil and time. Put in none through the oil hole, for the reason he states, viz., because it is likely to prove too much and get into the triple. The oil holes will be left out in future construction. With the triple piston out or in release position, the brake cylinder piston can readily be moved in and out when cleaning and oiling. If the triple is together and its piston not in release position, remove the graduating nut and push it to release with any clean instrument that will enter the opening. This is easier than using the oil plug. More than a slight deposit of oil in the bottom of the cylinder is of no advantage, and such an amount is assured by a good coating on the cylinder wall and the expander recess.

Undoubtedly the most desirable cylinder lubricant is one that will not flow from any natural heat, that is adhesive without tending to form gum or roll in lumps, that will not become too stiff in extreme cold, and that will tend to fill and preserve the leather.

The writer has not considered that any

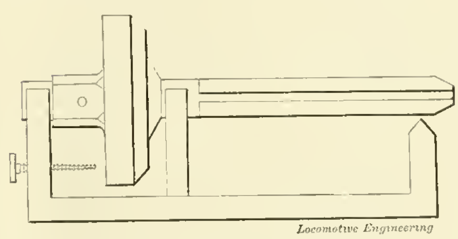


FIG. 1. TESTING OLD FORM EMERGENCY VALVE.

material gain would result from seeing that the same part of the leather did not remain at the bottom of the cylinder, though there is no objection to turning it. Nor is it considered important the position of the opening in the expander when in place; but a moderate and uniform pressure on the leather should be assured at all points. It should be seen that the follower bolt nuts are tight before replacing the piston.

Too much stress cannot be laid on the importance of keeping grit away from the triple piston and slide valve.

While true that very little oil is needed on the slide valve and its seat, yet it is felt that the instruction about oiling the piston may cause it to be given too little. The writer favors working several drops behind and at the sides of the packing ring, not only for the lubricating effect, but that the oil may better the ring-fit in the groove.

When taking down the triple note the size of the dirt in the small strainer, as by this a rupture in the large one will be indicated. See that the tension of the slide valve spring gives only very moderate resistance when the piston is moved back and forth after oiling. More than this is unnecessary and makes releasing slightly harder.

The workman should be impressed with the importance of a good-fitting triple piston packing ring, that the ring should never be removed or strained while cleaning, that it must be free, but not very loose, in its groove, and that it should show, by very fine cross lines, a bearing

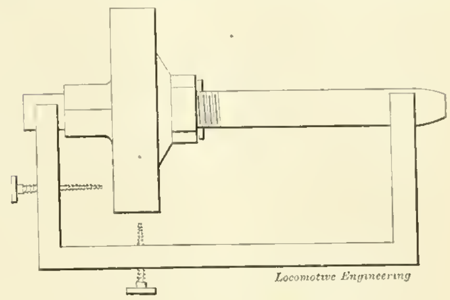


FIG. 2. TESTING NEW FORM EMERGENCY VALVE.

all the way around. A small dark spot where it comes next to the feed groove does not necessarily indicate a poor bearing, but more than this does. The fit should be tested, after cleaning and oiling, by making less than a full application and then slowly, by the gage, feeding up the train pipe pressure. Failure to release where the feed up is not excessively slow should require the valve being replaced and sent where it can be properly repaired.

The importance of the triple piston being true with its stem has caused some roads to supply the workman with a simple pair of centers (Fig. 3) for testing this. The bending is generally caused by loosening the cap bolts while there is pressure in the auxiliary reservoir, something that should never be done.

Another valuable device used to some extent is for testing to ascertain if the emergency valve stem is true, an important requisite. This valve should not bind

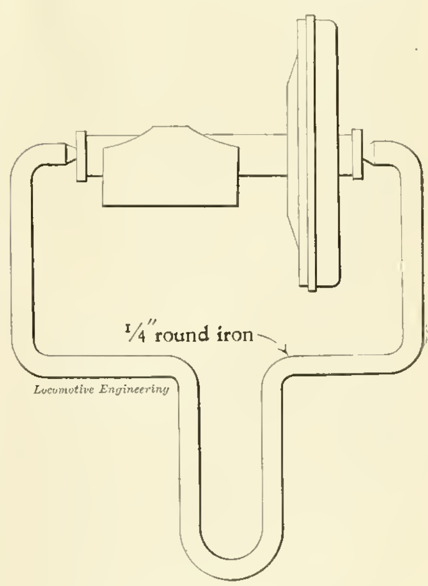


FIG. 3. TRIPLE PISTON TESTER.

where its lower stem enters the check valve. Press them together, with the spring in place, to test for this.

The recess for the emergency valve seat

in the check valve case should be cleaned so that the seat will enter freely to the desired depth. F. B. FARMER.

St. Paul, Minn.

Air Brake and Signal Testing Device.

Editor:

I have seen so many elaborate devices for testing air brakes at terminals, that I believe it would be interesting to many of your readers to see an equally efficient one that can be cheaply and quickly made at any roundhouse or car shop on the road.

The accompanying sketch shows the apparatus which we have used at several testing plants for a number of years with good results.

As shown, three hose couplings tapped to pipe size, three ½-inch stop-cocks, an air gage, a "bleeder" or release cock, and a piece of tin are combined with pipe fittings in a simple and compact manner.

By opening cocks 1, 2 and 3, both the train line and signal lines may be charged simultaneously. Then close 1 and 2 and note on the gage any leakage in the signal line, or leave 1 and 3 closed with 2 open and test leakage in train line. To apply the brakes, use small "bleeder" cock 4, preferably with about a 3-16-inch hole—the smaller, the more rigid will be the test of triple valve packing rings. The gage will show the reduction as well as indicate further leakage while brakes are being examined on train which is being tested.

To test the release of triples—perhaps the most important thing of all on the majority of roads in the country where very long, heavy trains on the comparatively level road are the desideratum—place the piece of tin *D* between the gaskets of coupling *A* and the yard hose, and require all cars to release with pressure supplied through about a 3-16-inch hole in this tin disk.

I say use *about* a 3-16-inch hole, because you may be testing a very long string of cars with a yard pressure much lower than the standard of 90 pounds, and so conditions will vary somewhat; but do not hesitate to make your requirements for release too rigid rather than too lax, and fewer trains stalled by brakes "refusing to release; cause unknown," and "brake stuck; wheels slid flat," will be had on your line. E. W. PRATT.

Ashland, Wis.

Another Tool for the Kit.

Editor:

In Mr. Blackall's list of tools for brake cylinder and triple valve cleaning I would say that a pair of 6 or 7-inch pliers will be found an invaluable tool in the kit for pulling cotter pins and doing other work. It is often trying to replace a cotter pin or a flat spring key that has had the points spread. Hold the key or cotter with the pliers, and then enter the point into the hole and drive. I have used pliers in many such cases and found them handy. Try them. H. COOK.

Pittsburgh, Pa.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(84) L. S., Chadron, Neb., asks:

How do you figure the brake cylinder pressure from an 8 or 10 or 12 pound reduction. A.—See method described in June number.

(85) F. A. P., Bainbridge, Ga., writes:

I have an air pump on my engine that gives a great deal of trouble by breaking air discharge valve. I think the valves do not have the proper lift. It is an old-style 6-inch pump. Will you kindly tell me what lift all of the air valves in this pump should have? A.—The valves break probably because they have too much lift. The lift should be ⅛ inch and 1-16 inch for the receiving and discharge valves, respectively.

(86) J. R. L., Charleston, S. C., asks:

If valves seat properly and no valves are broken, should any air come back to atmosphere out of air inlets while pump is at work? A.—No, at least none of any consequence. Should there, however, be a blow back, under the conditions above described, the receiving valve will be found to have too much lift. On the other hand, valves with insufficient lift will cause the pump to run hot. For the 8-inch pump, the receiving valves and discharge valves should lift ⅛ and 3-32 inch, respectively.

(87) J. R. L., Charleston, S. C., asks:

Will graphite do any good or harm to use in air end of pump, to make it quit groaning or to make it run cool? If good, is it best to use it dry or with oil? Should it be put in at air inlets or should oil cock be taken out and it introduced there? A.—Graphite is not good for the air cylinder, as it deposits and stops up the air passages. It might help stop groaning, but would leave a bad after-effect. A well-packed piston rod, packing loosely run a while with a well-oiled swab on it, will do more to stop groaning in the air end than anything else.

(88) J. R. L., Charleston, S. C., writes:

Please tell me how to go about measuring to a certainty the lift of receiving and discharge valves for a Westinghouse air pump. I know the lifts are ⅛ and 3-32 inch; but I don't know how to measure each so as to know how much to file off the "neck" or top of each new valve. A.—A unique and easy way to measure the lift of air valves correctly is to place a piece of putty or wax on the projection on the top of the valves, screw cap and cage to place, and thus get the true lifts. There are other methods of ordinary measurement which will suggest themselves.

(89) A. H. K., Tipton, Pa., writes:

In double-heading we have had it several times that the head engine could pump only 65 pounds of air on train line and 75 pounds on reservoir, and second engine would pump up to 70 and 90 pounds and hold it all right, head engine pumping all the time. Both were F-6 (1892 model) valves and 8-inch pumps. Please explain why this is. Both engines are cut into the train line. A.—The gages are out of register. The governor, being set by the gage on the engine, is also out and is stopping the pump before or after it should. See reply to J. R. L., in this department.

(90) W. J. P., Fond du Lac, Wis., writes:

What do you know about the Haberkorn air brake? I saw one of these on a C., H. & D. box car, the only one I ever saw. A.—This brake was invented and patented some years ago by Mr. Haberkorn, a master mechanic of the C., H. & D. road, but has been applied to very few, if any other, cars than a very limited number on the above named line. The brake is of the quick action, automatic type, but does not, we believe, conform to the Master Car Builders' requirements of a standard brake.

(91) E. D. R., Buffalo, N. Y., writes:

I was on a passenger train a few days ago that pulled into a side track to let another train pass. When we pulled out and stopped to let the hind man shut the switch, the conductor pulled the signal cord and immediately I heard the brakes go off. I didn't know the conductor could let off brakes with the signal cord. Please explain? A.—Brakes cannot be released with the signal cord. The engineer was perhaps expecting the signal, or maybe saw the switch closed and got the signal from there, and released the brakes just as the conductor pulled the cord. It was merely a coincidence.

(92) J. R. L., Charleston, S. C., writes:

My 8-inch air pump, air end, groans and "squeaks" badly and takes lots of oil to prevent this; and instructions say, "Never oil through air inlet to valves." How can I oil elsewhere while pump is at work? I always oil through oil cock before starting the pump, but very often have to oil while pump is working, and know no other way to oil there except through air inlets to valves. A.—Slow down the pump, fill the oil cup and open it as the piston starts on its downward stroke. Be quick, else the escape of pressure past the packing rings will blow the oil back. Sometimes slacking up the piston rod packing and giving the swab plenty of oil will stop the groaning.

(93) J. B. A., Auburn, N. Y., writes:

An engine was taken out of the roundhouse. The air seemed to be all right. We coupled to the train, and the brake on the tender went on and would not release. But when the train was cut off again the tender brake released all right. I said that the leakage groove was stopped up or that the piston travel was too short. Is there anything else that would do this? A.—Yes. Possibly the auxiliary reservoir was too large for the cylinder, which would cause the tender brake to set with a higher pressure. The driver brake was probably in poor condition and leaked off shortly after it set, thus making it look as though the whole trouble lay in the tender brake.

(94) P. R., Montreal, Can., writes:

I have a new semaphore air gage which will not register correctly. Will you please say whether this gage is used much in the United States? Also tell me the cause of the trouble. A.—The gage to which you refer is the new semaphore gage recently sent out by the Westinghouse Air-Brake Company and used quite extensively in the United States. Your trouble probably comes from using very high pressures where the quadrant is likely to pass beyond the extreme point where it will disengage from the pinion. Thus, you see, a cog will slip and cause a false register. The manufacturers are now making a projection on this quadrant so this trouble will not occur. See article on semaphore gage in May number of LOCOMOTIVE ENGINEERING, which will more fully answer your question.

(95) J. R. L., Charleston, S. C., asks:

What kind of material, and when and how can I best clean air end, valves and valve seats of the 8-inch pump to stop groaning? A.—Groaning is generally caused by insufficiently lubricated steam cylinder, improperly packed piston rod, dry air cylinder, and steam and air cylinders not being in line. The latter must be corrected by the machinist. The first and second are easily taken care of. The third may be looked after by either the machinist or engineer as follows: At a low speed cause the air pump to draw in a rather strong solution of lye, allow it to pass to main reservoir, and there draw it off. Follow with liberal supply of clear water, or water from the lubricator, then introduce a small quantity of valve or other good oil at the oil cup. Pack piston with fresh packing and let it run loosely a while with well-oiled swab on piston. Gradually tighten down the packing.

(96) F. J. T., Delray, Mich., writes:

In Questions and Answers or in Air-Brake Department give all details of care of air pump, amount of oil necessary in steam end and air end to keep pump properly lubricated. A.—Start the pump slowly, to work off the condensation, afterwards adjust the pump throttle to meet requirements of train, such as number of cars, leakage, etc. The lubricator should be started with the pump, and adjusted to lubricate well the walls of the cylinder after all water has passed off. Like the pump throttle, the lubricator should be adjusted to meet the needs of the train, which will dictate the amount of oil to be used. No arbitrary rule can be laid down, such as so many drops per minute, etc. Length of train, leakage—in fact, the work being done by the pump—will decide the amount of oil to be used. As little oil as possible should be used in the air cylinder, and that should be cylinder or other high-grade oil, and go in through the little cup and down the piston rod. A well-lubricated swab on the piston rod will often furnish the cylinder with all the oil it needs. Never put oil in through the air valves.

(97) C. A. H., Parsons, Kan., asks:

In equipping a car with the Stevens system of brakes, you multiply by 4, while with the Hodge you multiply by 2. Please explain why this is so? A.—The object sought is to find how the cylinder lever must be proportioned—that is, how much work the cylinder lever must be proportioned to perform. The proportion of the brake beam levers has already been found and the amount of work they shall do is therefore known. Consequently we multiply by 4 (the number of pairs of wheels under the car) with the Stevens system, because with that system the cylinder lever connects with a tie rod to the live brake beam lever. But with the Hodge system (where there are also four pairs of wheels under the car) the cylinder lever is connected to the middle of the Hodge lever, and one-half the pull goes to the truck and the other half to the hand brake. As but one-half the brake power is utilized, we must therefore multiply by 2 instead of 4 as in the Stevens system.

(98) R. E. H., Birmingham, Ala., writes:

Some time ago, on one of our roads running into Birmingham, two engines were coupled to an air-brake train of forty cars. The head engine took control of the train, but could not supply it with air, so engine No. 2 cut in to help. The engine in the lead had an 8-inch pump and D-8 (1890 model) engineer's valve; the second engine had 8-inch pump and D-5 (1892 model) valve. After the second engine cut in and began to help, the first engine gage registered 70 and 90 pounds, with pump under control of the governor. The second engine gage could not exceed 60 pounds, and pump running full force and brake sticking. Both engines showed 70 and 90 pounds before being coupled to the train. This has happened sveral times. A.—The gages evidently need adjusting; for two engines whose gages registered 70 and 90 pounds train line and main reservoir pressure, respectively, before being coupled up, registering differently when coupled into the same train pipe, proves that the gages would not agree on a testing machine. No doubt the first engine gage was light, or the gage on second engine registered heavy, the governors operating accordingly; thus allowing the first engine governor to stop the pump before the other did. The second engine alone tried to keep up pressure, but perhaps the leakage in the train pipe was too great to acomplish it. Thus when two pumps were most needed, only one was working. Leakage at high pressure is harder to keep up than at low.

(99) W. B., Mattoon, Ill., writes:

Please explain the following peculiar action of some freight car brakes. A freight train was standing at a station. The train was uncoupled for the purpose of cutting a crossing. After a period of about ten minutes the train was again coupled up, the air hose coupled together, angle cock on rear part of train was opened first, and brakes on rear portion of train applied lightly. When angle cock on forward part of train was opened brakes on rear part of train released and those on forward part of train applied, but immediately released on account of air pressure feeding back from the engine. Now, the forward brakes had hardly got through releasing when those on the rear part of the train, just back of the point where train had been separated, applied apparently to their full service application and could not be released from the engine, but had to be released by bleeding the auxiliaries. What caused those brakes to apply? What prevented their release from the engine? There were thirty-two air-brake cars working, and the point of separation was eighteen cars back of the engine. Those brakes worked all right both before and after this occurrence. A.—Possibly there was a New York triple valve or the first type of Westinghouse quick-action triple on the rear section, and when the hose was coupled and rear angle cock opened, that triple set in the emergency or with a hard service application—just hard enough to cock the vent valve 71—and allowed some of the train pipe pressure to escape through vent ports *M* and *J* of the New York triple, or the emergency valve of the Westinghouse. If main reservoir was small or excess pressure low, sufficient pressure would not be available to supply this waste and to throw the pistons 129 and 128 to release position, and thus relieve the vent valve 71. Hence bleeding would be necessary.

The Mayor of Jacksonville, when welcoming the Air-Brake Association to that city, paid a high and deserved compliment to the air brake, when he said that it was a greater saver of lives than all the life-saving stations in the world. The full truth of this remarkable statement will be better appreciated by the men who are a great deal on the road and by the man behind the valve.

Those persons who keep up to date in air-brake matters will be surprised at the exceptionally good discussions in the Jacksonville report of the proceedings of the Air-Brake Association. We believe we can safely say that the subjects and discussions this year are better than usual, and that the report will be an exceptionally valuable addition to air-brake literature.

Mr. Thos. L. Burton, formerly air-brake inspector and instructor of the Georgia Southern & Florida Railway at Macon, Ga., has resigned that position to accept a similar one with the Plant System at Savannah, Ga.

Crossing the Atlantic.

From a scenic standpoint, the Fourth of July is a good day to start upon an ocean voyage. All the ships in the beautiful harbor of New York are gay with flags that seem to whisper *bon voyage* to every traveler. Then on that day everyone is at leisure to go and see his friends off. By 11 o'clock the decks of the good ship "Majestic" appeared to hold half the population of New York, and an hour later, when "All ashore who are not passengers" had been repeated by the lusty voices of the ship's crew, a procession went along the gangway as crushing as the sidewalks of Broadway when St. Patrick's parade is passing.

In the old days the starting from its dock of an ocean steamer was a protracted operation, the hour of leaving being more nominal than real; being subject to delay for belated mail, passengers of high degree and favored freight. Now-a-days a different practice prevails. The White Star steamers start as promptly as the Empire State Express, unless they are delayed by the loading of mail. Uncle Sam has some very unpunctual servants in New York who need punching with a sharp stick. Just as the whistle proclaimed the hour of noon, our starting time, a string of vans, loaded with mail, came rushing upon the pier and an expectant gang of laborers was waiting to hustle the bags on board. We frequently receive complaints from foreign subscribers that their papers have been received in bad order, or have failed to come. After watching the manner followed of pitching the mail bags from vans to the ground, thence to the deck and into the hold, and then seeing the operation repeated at the other side, the wonder grows that any wrappers on the papers are left intact.

Although White Star steamers have the reputation of leaving promptly on time and we were delayed half an hour by the mails, the passengers who are always late came straggling on board until the vessel moved away. There seems to be a peculiarity among late passengers, that they need more time for farewell hugging and nose-rubbing than the people who come early, and do not have the whole of the passengers to witness their manner of going through the farewell kissing.

It is not sweet to have your friends on the dock waving their farewells for forty minutes with the thermometer at 90 degrees in the shade, but on this occasion they had to endure it or go, and they patiently waited until the huge vessel moved away. How gay the harbor looked with every vessel draped in bunting of all colors; but there was a sad sight which attracted all eyes, the blackened remains of the Hoboken wharves which had been burned a few days before, and the gutted hull of the "Saale," sunk near the Statue of Liberty. Before we reached the Narrows that form the entrance to New York harbor, the veterans of ocean travel had appropriated places for their deck chairs and were settled down to make themselves comfortable for seven days. Hardly had the decks got filled with loungers, when the usual Fourth of July storm came along in a fierce gale of wind that worked the sea into steely corrugations with whitened tops, and then came a terrific downpour of rain. Coney Island and Sandy Hook passed in dim shadow, and the vessel kept plowing the waves with a dark bank of cloud in front, out of which darted brilliant flashes of lightning. The pleasure of the day for deck loungers was over, and the cabins got filled up with readers, letter writers and diary scribblers. By the time that the fog which accompanied the storm had cleared away, we were out of sight of land.

Next day introduced the usual monotony of a sea voyage in good weather. A big ocean steamship is a good place to notice the determined search for amusement that prevails among the Western races when they have nothing to do. When a ship is carrying a load of Asiatics or Arabs, the people are seen to settle down into listless apathy. They pass the time in what appears to be a waking sleep. It is different with European races, which include all travelers from the American continent. After the novelty of starting is over, nearly everybody proceeds to find some sort of amusement, and they keep it up during the whole voyage. There are some who succumb to laziness and appear to sleep through the whole voyage when they are not eating; but the big majority are reading, writing or playing games.

On this voyage there were an unusually large number of people who passed their time writing; but that was because we had a crowd of Christian Endeavorers, mostly young women of pious proclivities. Along with many others who start on a foreign trip for the first time, they keep diaries, which are written up with great care for a few days, and then gradually dropped. The outdoor games on shipboard consist principally of throwing rope quoits and playing shuffle-board, which consists of pushing wooden disks upon a hop-scotch figure. Sometimes they have tugs of war, in which the two opposing sides tug on a stout rope, the side that drags the other being the winner. It is a rough game, but makes lots of fun.

An ocean liner is a sort of small world in itself and represents fairly well the various characteristics of the greater world ashore. As soon as the people get settled down, they begin to join together into groups that form the nucleus of a society with more or less exclusiveness towards others less select. It also soon becomes evident that the lower grades of the people take much more enjoyment out of life than those robed in mantles of gentility. All day long the steerage is a scene of gayety, singing, dancing, horse-play and games keeping the place lively and the people amused.

The "Majestic" is now a little behind the most famous ocean liners, but she is a fine vessel, and the most comfortable boat I ever crossed on. She is 582 feet long, 57 feet 8 inches beam and 39 feet 3 inches deep. She has two sets of triple-expansion engines, with cylinders 43, 68 and 110 inches diameter by 60 inches stroke, which develop 18,000 indicated horse-power and drive the ship about 19 knots, or 22.23 miles, an hour. These engines started up at the dock in the Hudson River, and they have churned the propellers without a sin-

Photo by A. H. Chamberlain.

A MAZE OF TRACKS—BOSTON & ALBANY EXPRESS.

gle stop, and we are now moving along the Irish coast, seven days out.

To generate the steam for these engines and for others of smaller importance, there are sixteen boilers with seventy-six corrugated furnaces, that do their work under forced draft, the air pressure being about 3 inches of water, nearly as great as the suction in the smokebox of a hard-working locomotive. Attending to the machinery part of the vessel there are twenty-two engineers, six leading firemen, thirty greasers, sixty firemen, forty-two coal-passers and three stewards. Besides these there are 192 other people engaged in the handling of the ship and in taking care of the passengers. On this trip there are 278 first-class, 164 second-class and 707 steerage passengers on board, making a total of 1,504 passengers.

Besides the main engines there are two refrigerating plants, four electric lighting dynamos and a variety of other engines used for fan driving and other purposes. There are many difficulties incident to the taking care of machinery at sea which try the souls of chief engineers, but those connected with the care of refrigerating machinery are the worst. If anything goes wrong with the refrigerating machines, hundreds of tons of dead meat and other perishable articles are likely to be ruined. The cold-storage departments must be kept at an even temperature of 29½ degrees Fahr., and it is very difficult holding it at that with the changing temperature of the North Atlantic.

The forced furnace draft has some peculiarities that were new to me, and which might be imitated, with modifications, in locomotive and stationary boiler practice. The gases that escape from the boiler tubes are passed through tubes contained in a heating box, and the air for supplying the furnace is forced through this box, where it gets heated to about 240 degrees Fahr. This is utilizing waste heat in a very profitable way, for it not only saves heat directly, but keeps up the furnace temperature considerably higher than cold air would do. The cinder pit, where the air enters, is of course air-tight, or nearly so. They inject two-thirds of the air into the cinder pit and one-third into the furnace direct.

The rugged shores of the Green Isle are in sight, so my trip across the Atlantic is once more finished. S.

The Kincaid Mechanical Stoker.

The mechanical stoker invented by J. W. Kincaid, a locomotive engineer of the Chesapeake & Ohio Railway, which has been operated on that road at various times during the last twelve months, has been improved by eliminating the mechanical difficulties encountered in its operation, as far as possible, so that it is now about ready for an extended test for durability.

This stoker throws small charges of coal—about 6 pounds at a time—into the firebox through an opening in the door, using steam from the boiler to operate the mechanism. It can be so adjusted as to scatter it on the grate up next the flue sheet or drop it next the door. When in operation, each charge is scattered in its turn at a different place on the grate, which keeps a level fire. It can feed fast or slow, according to the rate at which the coal is burned. It has been used with various kinds of coal, and so far the fires have neither clinkered nor banked.

In case of any break-down of the stoker, it can be uncoupled and moved away in three minutes, leaving the fire door all ready for hand-shovel firing.

It is the intention to have one of these stokers at Cleveland, Ohio, at the meeting of the Traveling Engineers' Association, on September 11th next.

Something Cooling for a Hot Day.

In the hot days of summer we realize most vividly how much we are dependent on the movement of air to secure our comfort. It is not enough, however, to merely agitate the air with a fan, but in most cases we are distinctly dependent upon a change in the atmosphere within the room, which can only be secured by forcing in the air or by withdrawing it by positive means and permitting a fresh supply to enter to make good the loss. For the purpose of securing such results an electric ventilating fan like that shown in the accompanying illustration is almost invaluable. It may be attached to an opening in the wall and arranged to force into or draw directly from the room, or it may be connected to a system of air ducts through which movement is maintained.

A NEAT FAN.

The illustration serves to show a special type of electric ventilating fan built by the B. F. Sturtevant Company, of Boston, Mass, which is especially designed to meet the above conditions. These electric fans are built in sizes ranging from 18 to 120 inches in diameter, driven by motors ranging from 1-6 to 14 horse-power, according to size, and handling from 2,000 cubic feet per minute in the smallest plant up to 175,000 in the largest.

Trolley Car Helps a Fire Engine.

A fire engine on a run to a fire got into an excavation in the street and stuck there. The horses managed to get out. A trolley car came down the line, hitched on to the rear of the engine, and with one pull brought the engine out of the hole. The driver, who was strapped to his seat on the engine, took it easy till someone unloosened the straps, and a Babcock having put out the fire, all was serene again.

Mr. George P. Whittlesey announces that he has moved his office from the Atlantic Building to the Washington Loan & Trust Building, 902 F street, N. W., Washington, where he will be pleased to receive his clients and other friends and acquaintances. Mr. Whittlesey will continue, as heretofore, to prosecute applications for patents, make preliminary and validity searches, prepare opinions, give expert testimony and render such other professional services as may be desired.

An interesting story of young men who have fitted themselves for good positions in architectural, mechanical and electrical engineering work is told in a little book called "Support Yourself While Learning a Profession." Its motto is, "To earn more, learn more," and the value of a technical education and the ease with which it may be acquired are illustrated with many examples of young men who have spent their spare time in study and risen from the ranks to important positions in professional life. The book will be sent free on application to The International Correspondence Schools, Scranton, Pa.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

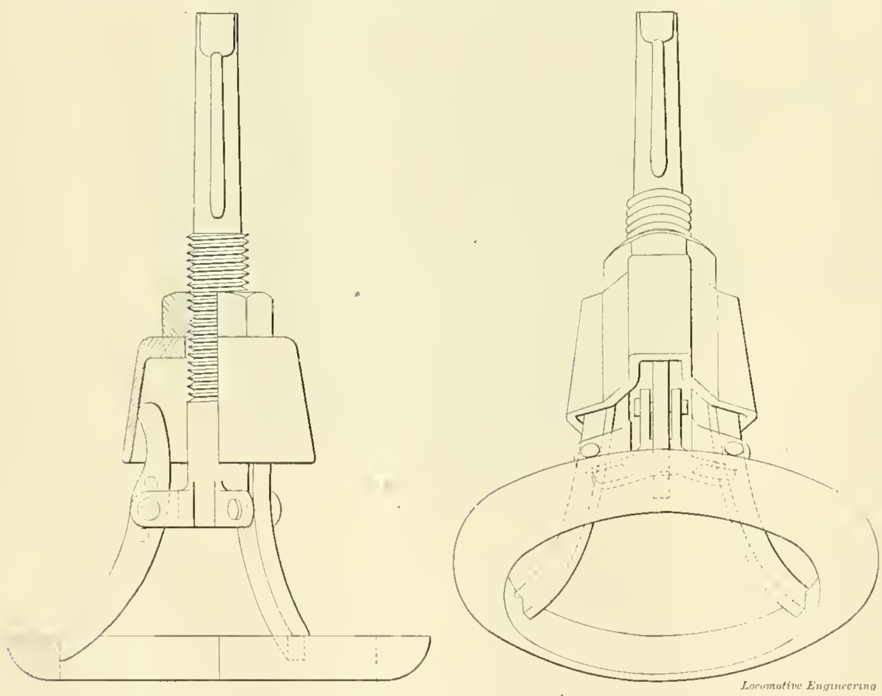
(71) S. C. C., Hartford, Conn., asks:

Why are some stacks made with an inner and outer shell? A.—To give an air space to keep the outer shell cool and prevent its being cut away by cinders. This was done when sheet-metal stacks were used. The cast-iron stacks now used do not require it.

(72) V. J., Ocklawaha, Fla., asks for diagrams of front and back ends of main rod and full directions for filing. A.—There are so many varieties of rod ends that it would be impossible to do as you request, unless we knew what style rod you are using. It is well to remember that brasses must be kept true in rod or strap and must not be allowed to pinch at top and bottom. The fillet is the rounded edge at each end of bearing. 2. We do not know who makes the Cyclone valve cock.

(73) D. M. M., Omaha, Neb., asks:

What is your first duty after a breakdown, and what should be done next in order? A.—The first duty after a breakdown, after getting stopped, is to see that you are protected in both directions from approaching trains, both for your own safety and for theirs; and, if necessary, look out for the fire; with some breakdowns it is necessary to kill the fire. The next duty is to locate the damage, to see at once if any outside help will be needed, and the kind of help needed, so that it can be sent for at once, or a report made of the parts disabled and the probable length of time before the engine can proceed with the train. The next duty is to get the engine ready to move as soon as possible, and with as little delay as possible after you get under way.



CHUCK FOR GRINDING IN STEAM PIPE RINGS.

(74) W. McK., Boston, Mass., asks:

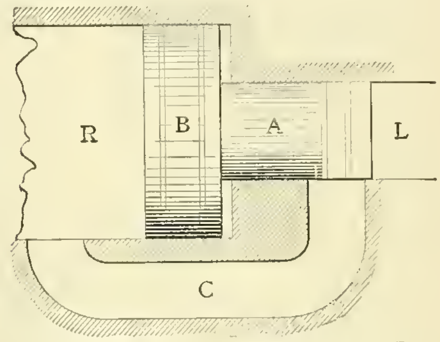
Why are boiler checks set as far ahead as possible? A.—So that the water of the lower temperature will enter the boiler as far from the firebox as possible and work from the point of least evaporation towards where the greatest evaporation is taking place; this helps out the circulation of the water and reduces the strains from expansion and contraction when the feed water supply is increased or diminished. Then the coolest water should enter where it will strike the flues just before the hot air and gases pass into the smoke arch. The cool water will absorb more heat from the hot gases just before they pass out of the flues than if this water was admitted at some other point and had been heated to a high temperature. The idea is to absorb as much heat as possible from flues.

(75) H. F. G., Louisville, Ky., asks:

What is the extra steam port leading over the top of the Allen valve for? A.—This extra port you speak of is to give a double port opening from the steam chest to the cylinder at the instant the valve begins to admit steam to the steam port. This Allen port extends around above the exhaust cavity, so that one end is over the steam port at the time the other end is passing out beyond the edge of the valve seat at the opposite end. This lets steam pass into the steam port through two openings, one at the edge of the valve, and one through the Allen port. These ports are usually ⅜ inch wide, so that the steam opening is doubled for that travel of the valve, or ¾-inch steam opening, which being at the beginning of the stroke, is just at the time it is needed. For that reason the Allen valve is often set with no lead.

(76) H. P., Delray, Mich., says:

Will you please advise me as to the cause of sight-feed glass on lubricator filling with oil? A.—There are several reasons for this, any one of which may cause the glass tube to fill with oil. Some of them apply to one make of lubricator and not to others. A general cause which applies to all makes is, the glass and passages above it to the steam passages get gummed on the inside, so that the oil will stick there, and does not have buoyancy to rise any higher. If you will clean the cup and oil passages out with strong soapsuds, leaving some of the soapy water inside the glasses, it will cure this trouble. If the passage between the condenser and oil tank gets stopped up, oil from the oil pipes will work back into the glasses, and then into the oil tank. In some makes of lubricators there are check valves located



DIFFERENTIAL PISTON REDUCING VALVE.

at the top of glasses, which get stuck and prevent the oil passing up. Occasionally a porous casting in the top arm will allow oil to get in at the top end of feed glass.

(77) D. H. S., Greely, Colo., asks for an explanation of the action of a differential piston reducing valve. A.—This is very simple when once thoroughly understood, although not always clear at first sight. Let the cut below be taken as an example. The reducing piston is *B A*, *A* being the small end, and representing the high-pressure cylinder, while *B* represents the low pressure. Suppose the ratio is 3 to 1—that is, the low-pressure cylinder has three times the area of the high—then the area of *B* will be three times the area of *A*. Calling A 10 square inches and *B* 30 square inches, then 50 pounds in receiver *R* will balance 150 pounds against *A* from the live steam passage *L*. This is easily proven by comparing total pressures on each end. For 150 pounds on each 10 inches gives 1,500 pounds total on *A*, and 50 pounds on each 30 inches of *B* also gives 1,500 pounds there—consequently they balance each other. Now, suppose low-pressure piston takes steam and reduces receiver pressure. Live steam on *A* immediately overbalances *B* and forces valve to left, steam flows through *C* into receiver until pressure there overbalances live steam on *A* and closes *A* entirely, or enough so that the steam withdraws and reduces pressure to desired amount. It is one of the prettiest and simplest of steam-engineering mechanisms.

Personal Department.

Mr. W. H. Hill has been appointed master mechanic of the Cornwall Railroad at Lebanon, Pa.

Mr. C. Murphy has been appointed division superintendent of the Canadian Pacific at Chapleau, Ont.

Mr. J. M. Fowle has been appointed master mechanic of the Trinidad division of the Colorado Midland.

Mr. D. R. Boardman has been appointed master mechanic of the Gila Valley, Globe & Northern at Globe, Ariz.

Mr. C. H. Bristol has been appointed trainmaster of the Atchison, Topeka & Santa Fé at Las Vegas, N. M.

Mr. B. A. Newland has been appointed trainmaster of the Atlantic & North Carolina Railroad at Newbern, N. C.

Mr. J. J. Cavanagh, foreman of the Mexican Central at Cardenas, has been transferred to Dona Cicilia, Mexico.

Mr. Harry F. Anderson has been appointed trainmaster of the Galveston, Harrisburg & San Antonio at Del Rio, Texas.

Mr. K. H. Nichols has been appointed trainmaster of the Wheeling & Lake Erie at Massillon, O., succeeding Mr. E. C. White.

Mr. W. W. Layman has been appointed acting master mechanic of the Ohio River at Parkersburg, W. Va., vice E. LaLime, deceased.

Mr. W. N. Schoff, purchasing agent of the St. Paul & Duluth, has resigned to accept a similar position with the Colorado & Southern.

Mr. W. N. Whitney has been appointed assistant superintendent of the Union Pacific at Laramie, Wyo., succeeding Mr. J. W. Hay, resigned.

Mr. H. B. Minnich has been appointed general foreman of the Lake Erie & Western shops at Lima, O., succeeding Mr. Chas. Riley, resigned.

Mr. W. C. Wilson has been appointed master mechanic of the Terminal Railway Association of St. Louis, succeeding Mr. H. M. Smith, resigned.

Mr. Thomas Treleaven has been appointed master car builder on the Grand Trunk at London, Ont., succeeding Mr. Samuel King, resigned.

Mr. Jacob B. Bronson has been appointed master mechanic of the Erie & Wyoming Valley at Dunmore, Pa., succeeding Mr. D. E. Barton, resigned.

Mr. R. D. Whitehorn has been appointed general foreman of the Norfolk & Southern at Berkeley, Va., succeeding Mr. R. P. Schilling, resigned.

Mr. Joseph G. Trego has been appointed assistant road foreman of engines on the Philadelphia division of the Pennsylvania Railroad at Harrisburg, Pa.

Mr. Samuel King, master car builder of the Grand Trunk at London, Ont., has resigned to accept a similar position on the Intercolonial at Moncton, N. B.

Mr. J. K. McPherson has been appointed foreman at Council Bluffs, Iowa, on the Chicago & North Western Railway, vice Mr. W. H. Hufman, promoted.

Mr. F. W. Peterson has been appointed foreman at Carroll, Ia., on the Chicago & North Western Railway, on account of the promotion of Mr. W. H. McCune.

Mr. C. F. West, acting master mechanic of the Baltimore & Lehigh, has been appointed master mechanic in place of Mr. C. W. Seidel; office at Baltimore, Md.

Mr. J. J. Barrett, chief train dispatcher of the Minneapolis & St. Paul, has been promoted to the position of trainmaster, succeeding Mr. C. E. Dafoe, resigned.

Mr. W. F. Deane, purchasing agent of the Ohio River, has resigned and been appointed general manager of the Butte, Anaconda & Pacific at Anaconda, Mont.

Mr. A. L. Humphrey, superintendent of motive power of the Colorado Midland, has been appointed to a similar position on the Colorado & Southern at Denver, Colo.

Mr. E. R. Webb, road engineer on the Michigan Central, has been promoted to traveling engineer west of the Detroit River, succeeding Mr. D. R. McBain, promoted.

Mr. Chas. D. Hilferty has been appointed general foreman of the Michigan Central shops at Jackson, Mich. He was formerly with the Richmond Locomotive Works.

Mr. T. A. Summerskill, master mechanic of the Gila Valley, Globe & Northern, has resigned to accept the position of locomotive foreman on the Grand Trunk.

Mr. W. H. McCune has been appointed foreman at Belle Plaine, Ia., on the Chicago & North Western Railway, on account of the promotion of Mr. J. K. McPherson.

Mr. J. H. McGoff has been appointed division master mechanic of the Northern Pacific, to take charge of the St. Paul & Duluth. He succeeds Mr. Geo. D. Brooke, resigned.

Mr. W. C. Squire, recently engineer of tests of the Atchison, Topeka & Santa Fé, has been appointed mechanical engineer of the St. Louis & San Francisco at Springfield, Mo.

Mr. J. R. O'Rourke, general foreman of the Southern shops at Augusta, Ga., has resigned and accepted a similar position with the Atlantic Coast Line at Rocky Mount, N. C.

Mr. S. C. Graham has been appointed master mechanic of the Iowa and Minnesota divisions, Chicago & North Western Railway, with headquarters at Belle Plaine, Iowa.

Mr. J. F. Fleischer has been appointed master mechanic at Kaukauna, Wis., of the Ashland division, Chicago & North Western Railway, vice Mr. A. W. McLean, resigned.

Mr. W. H. Hufman, of Council Bluffs, has been appointed general foreman at Boone, Iowa, on the Chicago & North Western Railway, vice Mr. F. G. Benjamin, promoted.

Mr. Sanford Keeler has been appointed general purchasing agent of the Gulf & Manitoba at Beaver Falls, Minn. He was formerly general manager of the Saginaw, Tuscola & Huron.

Mr. R. P. Schilling has been appointed master mechanic of the Delaware, Lackawanna & Western, at Syracuse, N. Y., succeeding Mr. F. W. Williams, transferred to Buffalo division.

Mr. Walter F. Dixon is no longer with the Sormovo Locomotive Works at Nijni Novgorod, Russia, but is now with the Kompanaya Singer, Podolsk, Moscow Government, Russia.

Mr. Charles T. McKelvey has been appointed general manager of the Ohio Southern at Springfield, Ohio. He was formerly general superintendent of the New York, Susquehanna & Western.

Mr. F. E. Blaser, recently appointed purchasing agent of the Ohio River, has been advanced to the position of general superintendent, vice J. H. Hamilton, deceased; office at Parkersburg, W. Va.

Mr. George D. Brooke, master mechanic of the St. Paul & Duluth, has resigned to accept the position of master mechanic and master car builder of the Iowa Central at Marshalltown, Ia., succeeding Mr. B. Reiley, resigned.

Mr. F. G. Benjamin, lately general foreman at Boone, has been appointed master mechanic at Eagle Grove, Ia., of the Northern and Western Iowa divisions, Chicago & North Western Railway, vice J. F. Fleischer, transferred.

Mr. E. A. Richardson, general foreman of the car shops of the Philadelphia, Wilmington & Baltimore at Washington, D. C., has resigned to accept the position of master mechanic on the Chicago & Alton at Bloomington, Ill.

Mr. James T. Wallis, assistant master mechanic of the Altoona shops of the Pennsylvania, has been advanced to the position of assistant engineer of motive power on the lines east of Pittsburgh and Erie; headquarters at Altoona, Pa.

Mr. Edw. W. Hurley, president of the Standard Pneumatic Tool Company, left for Europe recently for the purpose of establishing works in Germany and France for the European trade. He will be glad to see any of his friends at the Paris Exposition in the Champ de Mars and Park Vincennes.

Mr. C. O. Brunner, treasurer of the Bethlehem Iron Company and Bethlehem Steel Company, completed on July 12 his fortieth year of service. The occasion was marked by the presentation to Mr. Brunner of a silver pitcher and salver and a handsome cane from his fellow members of the staff of the two companies.

Mr. L. G. Barger, for many years with the transportation department of the West Shore Railroad, and recently connected with the New York Air Compressor Company, New York, has accepted the position of chief clerk to Superintendent Ketcham on the Morris & Essex division of the Delaware, Lackawanna & Western Railroad.

Mr. A. B. Holmes, who has been connected with the Standard Pneumatic Tool Company since their organization, has been appointed assistant manager, and will be located at Marquette Building, Chicago, Ill. The Standard Pneumatic Tool Company have also opened offices at 217 Ferguson Building, Pittsburgh, Pa.; Mr. Wm. Jennings in charge.

J. G. A. Meyer, well known as the author of "Modern Locomotive Construction," and later "Easy Lessons in Machine Design," as well as a former associate editor of the "American Machinist," died of apoplexy at his home, in Paterson, N. J., on July 16th. He had quite a circle of acquaintances and readers who will be shocked to learn of his sudden death.

The following changes have been made on the Northern Pacific: Mr. E. C. Blanchard has been appointed superintendent of the Minnesota division of the Northern Pacific at Minneapolis, Minn., vice Mr. A. E. Law, appointed acting general superintendent; Mr. E. L. Brown, superintendent of the St. Paul & Duluth, has been appointed superintendent of the Lake Superior division at Duluth, vice Mr. Blanchard.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, Chicago, Ill., who returned to Europe on the "Kaiser Wilhelm der Grosse," on July 3d, for an extended stay at the Paris Exposition, invites customers and friends of the company who visit the Exposition to call on him at their exhibit in the American Machinery Building, Vincennes, in Space 1, Block 9, or at the Palace of Machinery and Electricity, Champ de Mars, Space 1, Block 14, where he will be pleased to meet them and extend any courtesies that will be acceptable in looking up points of interest.

Mr. Charles C. Newton, of the Newton Machine Tool Works, of Philadephia, is now abroad on his annual trip especially looking after, this year, the business for the foreign electric manufacturing companies and the new armor plate works. The Newton Machine Tool Works at the present time are building some of the largest portable tools that have ever been built; they are building portable slotting machines with a stroke of 8 feet. These machines, with their motors, will weigh about 60,000 pounds.

Mr. D. R. McBain was appointed master mechanic at Michigan City, Ind., for the Michigan Central Railroad, on July 1, 1900. He will have jurisdiction over the west-end engines and men, including both the car and locomotive departments on the Joliet division, succeeding Mr. J. G. Riley, who continues in charge of the car and locomotive departments in the Chicago jurisdiction. Mr. McBain began his railroad service on the Canada Southern division of the Michigan Central, as a fireman, in October, 1876; was promoted to engineer in November, 1882, and in May, 1890, was appointed traveling engineer. He was transferred to the Michigan side in June, 1893. Mr. McBain has been an active working member of the Traveling Engineers' Association since its inception. He was president for two years, 1898 and 1899. As an educator in the practical operation of locomotives and trains, his name is well known from his frequent contributions to that cause. He will have that success in his new position which ability insures.

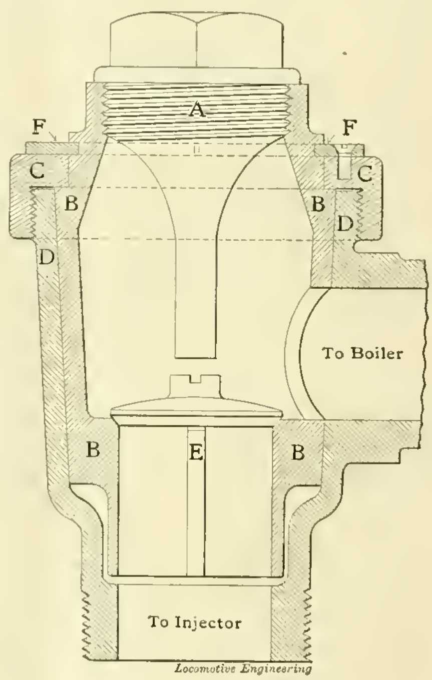
Jasper R. Rand, president of the Rand Drill Company, died last month, aged sixty-three. He was born in Westfield, Mass., and obtained his education in the public schools and academy of his native town and in Fairfax, Vt. His earliest business connection was with his father, who was a manufacturer of whips when Westfield was the headquarters of that industry. In 1865 his father retired from business, and Mr. Rand and his younger brother, Mr. Addison C. Rand, succeeded him. In 1870 he removed to New York, and was for a time associated with another brother, Mr. Albert T. Rand, president of the Laflin & Rand Powder Company. In 1872 Mr. Addison C. Rand began the manufacture of the Rand rock drills and other mining machinery, and the two brothers subsequently organized the Rand Drill Company, with Mr. A. C. Rand as president and Mr. J. R. Rand as treasurer, which arrangement continued until the death of Mr. A. C. Rand, in March, which left the chief office vacant, when Mr. J. R. Rand was elected to the position.

A Novel Boiler Check.

Leaky boiler checks are always a source of annoyance, and it is to lessen this that the boiler check shown with this was designed by Mr. C. F. Jones, of Cedral, Mexico.

As will be seen, there is the main body *D* in which is the cage *B*. This is held in place by the cap *C*, and the ring *F* affords a means of removing the cage when necessary. Inside the cage is the check valve *E*, the lift being controlled by the projector on cap *A*, as is usual.

In case of a check leaking, the cage *B* can be turned like a plug cock, and acts as stop valve between boiler and injector. By removing cap *A* the valve can be reground with a screwdriver, and after grinding, the cage is simply turned back to its original position.



COMBINED CHECK AND STOP VALVE.

As suggestive of the fact that just as hot and fluid iron can be produced in a cupola operated by a fan blower as is necessary even for stove foundry conditions, the following statement from James McKinney & Son, of Albany, N. Y., is of interest: "We cannot use a dull iron, therefore the above melting (9½ pounds of iron per pound of coal) means that the iron comes out of the cupola just as hot as would be used in the ordinary stove foundry. We can melt on an average in our cupola five tons in not to exceed one hour. In many cases we do much better than this, depending upon how much we let the blast in. In a heat of ten tons we can melt the iron in from 1½ to 1¾ hours."

Compressed air traction had advocates as early as 1830, and Mann even went so far as to issue a book on the subject.

A Veteran Engineer.

Joseph West, whose portrait appears on this page, is still in active service as an engineer on the Baltimore & Ohio Railroad. Mr. Joseph Billingham, master mechanic at Cumberland, Md., interviewed Mr. West at our request and sends us the following biographical notes:

He was born in 1825, exact date not known, in Berkley county, West Virginia, and at fifteen years of age secured employment as track hand. When about eighteen he went to braking, and in 1847 he was a freight conductor, but he wanted to fit himself for an engineer, so as soon as opportunity offered he went to firing, and in a little more than a year he was promoted and handled the throttle on the old grasshopper types of engines, among others the "Phineas Davis" and the "George Clinton," both built in 1836, and

JOSEPH WEST.

then running on the main stem east of Cumberland.

Mr. West has been in service on all of the different districts between Baltimore and Wheeling, and his service has been continuous except for about six months during the civil war, when he was on the Northern Central, on account of Baltimore & Ohio rails having been torn up by the Confederates in the neighborhood of Harpers Ferry. He returned to the Baltimore & Ohio as soon as they were again ready for business.

Mr. West advises that during about forty years of his career as engineman his runs were more than half night runs. During his entire railroad experience, most of it in passenger service, he has never had a passenger or member of his crew injured in any way, and he has never been in any kind of wreck.

Mr. West has reared a family of thirteen children, and now has two sons running and one firing on the Baltimore & Ohio.

Echoes of the Convention.

Reduced Weight of Freight Cars, Due to Drying Out of New Lumber.—It is a well-known fact that a newly-built car is not always constructed of thoroughly dried-out lumber, and that the car will not weigh as heavy a few months after being in service as when first built. This is due to the lumber drying out during the summer months, and will frequently cause a reduction in weight of 1,000 to 2,000 pounds. Thus a car originally weighed and stenciled may be found to be much lighter upon reweighing a few months later.

Inadequacy of Present Draft Gear.—Attention was called to the incapacity of the present draft spring, and it was thought the Master Car Builders should direct their attention to the friction draft gear, a really efficacious device, which is coming into the market. The present draft spring, it was said, has a capacity of 19,000 pounds, while the tractive power of many of our modern locomotives is 30,000 pounds, thus compressing solid the springs when the locomotive exerts its maximum traction effort. The friction draft gear, however, consuming or absorbing blows of destructive force, has practically no compression or tension limit, and presents a characteristic and novel elasticity at all times.

Fuel Economy of the Compound.—Angus Sinclair said that his test of the first compound locomotive on the Michigan Central showed a saving in fuel of 16 to 20 per cent. in heavy freight service; but no appreciable saving in light passenger work.

American Compound in the Lead.—"The compound engine is a more perfect machine as it exists in this country than can be found, I believe, in any other country. I have had some opportunity for inspecting work on that line. Russia and France have probably reached a higher conception of the advantages of the compound locomotive; but in designing and building compounds we certainly lead them all."—Prof. W. F. M. Goss.

Requires Less Lubrication.—The compound was declared to require less lubrication than the simple engine; but it was deemed inadvisable to attempt any saving on this item.

Intervals Between Cleanings.—Mr. H. J. Small, of the Southern Pacific Company, suggested that six months should be the time limit for cleaning brake cylinders and triple valves, instead of twelve, as recommended by the Master Car Builders' code. He was voted down.

Reweighing and Stenciling Cars.—Freight cars should be reweighed and stenciled about a year after being built. This gives time for the new lumber to dry out, a correct weight to be had, and would reduce the tendency towards slid flat wheels.

Two Methods.—The friction draft gear absorbs and kills the blow thrown on the draw head, while the spring type merely stores the shock which kicks out with destructive force when tension or compression is released.

Must Be Maintained and Made Efficient.—The Interstate Commerce Commission has administered a gentle prod to the Master Car Builders in reminding them that the mere equipment of cars with automatic couplers will not suffice. They must be kept up. Will the commission ultimately get its nose into the air brake and brake shoe questions?

Code Generally Satisfactory.—The very few changes suggested in the standards and recommended practices of the Master Car Builders' Association seem to indicate that the code in general is in a quite satisfactory condition.

Responsibility of Delivering Road.—The delivering road will be responsible for missing air-brake hose, air-brake hose or steam hose and fitting, angle cocks, cut-out cocks, triple valves, release valves and pressure retaining valves, or for 1-inch hose applied to 1¼-inch fittings; and also for damage to any part of the brake apparatus caused by unfair usage, derailment or usage.

Proper Maintenance Facilities.—Well-behaved steel cars and trucks are beauties and joys to look upon; but when scapegoats in a wreck, twisted and tangled, they paralyze the plain wood-working car repairer. With higher speeds and increased traffic steel construction has come to stay. Maintenance facilities should be accordingly prepared.

Cost of Freight Car Maintenance.—It is the opinion of experts that $50 per year is a reasonable estimate for the necessary maintenance of a wooden freight car. Steel cars are less expensively maintained.

Better for Brakemen.—The Master Car Builders will henceforth extend the uncoupling lever to both sides of the car, instead of to one side only as in the present practice.

Merging of the Car Shop into a Boiler Shop.—In the discussion of repairs to steel trucks and steel cars the consensus of opinion seemed to be that the old-time wood-working car shop would soon pass into something more nearly approaching a boiler shop, now that steel has entered so largely into car construction. Railroads should prepare for this coming change, for sending cars and trucks to the manufacturer is too expensive a practice to continue with profit to railroads.

Responsibility of Owners.—Owners will be responsible for defective, missing or worn-out parts of brakes which have failed under fair usage, and also for cylinders or triple valves not cleaned and oiled within six months and the date of last cleaning and oiling marked on the brake cylinder with white paint or red pencil.

Repairs Facilitated.—To facilitate repairs, the Master Car Builders' Association now recommends that a train pipe nipple, 10 inches long, be inserted immediately back of the angle cock. In the event of damage to the threaded end of the train pipe, repairs can quickly be made by introducing a new nipple instead of having to take down the entire train pipe, as is now the case.

Compound Locomotive Not an Experiment.—No doubt the replies to the committee's letter suggested and caused it, but paragraph 1 in the report, which read, "Compound locomotives have not come into general use in America, but are gradually emerging from the experimental stage," soon found itself like a squad of hostile soldiers within the enemy's lines in war time. Mr. S. M. Vauclain, from a "kopje" of record and experience, poured into it such a withering fire of logic and facts that it was swept from the "veldt." He showed that more than 50 per cent. of the modern American locomotives now supplied by the Baldwin Locomotive Works were built on the compound principle. Several other builders and users entertained like opinions and spoke to the point. The result was the objectionable paragraph was stricken from the report.

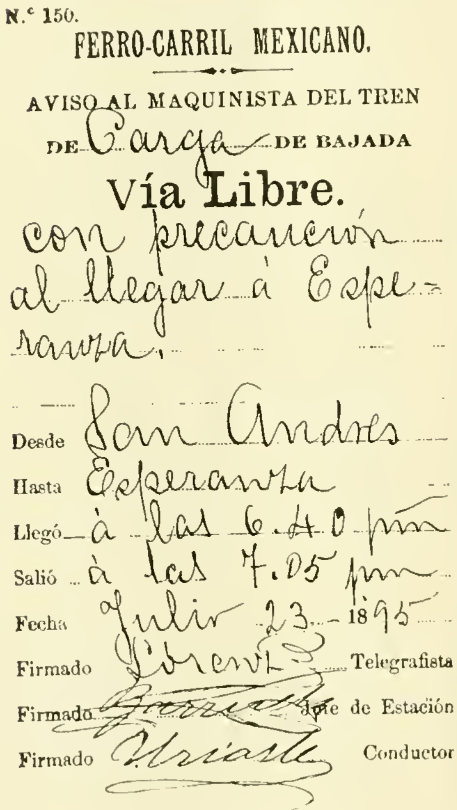
A Forcible Illustration.—The fact that about 30 per cent. of the freight cars going to the repair tracks exhibit mutilated ends, with drawbar missing, draft timber gone and possibly the whole end of the car gone, is a well-illustrated example of the need of a better draft gear than the type used at present.

The Sluggard to Become Industrious.—Never was the brake-shoe question in better shape than the Master Car Builders now have it. Henceforth, brake shoes to receive their endorsement must furnish a specified retarding effect. The harder brake shoe, whose only recommendation is that it "will never wear out," must embrace the new religion of doing work. It must have friction and must hold.

Handicapping a Good Air Brake.—To buy a thoroughbred horse and then harness him to a dray is a simile used by Mr. Godfrey W. Rhodes to illustrate the bunghole policy of some roads which purchase the best air brakes to stop their high-speed trains, and then put on brake shoes which wear indefinitely, but do not furnish reasonable retarding effect. It is a sad truth that too many roads regard frictional qualities of brake shoes too lightly, and are easily won over to a shoe that "will never wear out."

Timely Recommendations and Worthy Suggestions.—The Master Car Builders' committee reporting on air-brake appliances recommend that closer attention be given to correct piston travel; that the piston and attachments be removed from the cylinder in order to receive proper cleaning; that more care be given to bending of pipe and elimination of ells to reduce friction of air, and that a specified angle from the vertical be established for the angle cock. The committee recognizes the superiority of a suitable grease over oils for brake cylinder lubrication, and believes that advantageous investigation could be made of slack adjusters, additional brake power for high-capacity cars, and brake beams for same.

Untried Brake Shoes Must Prove Themselves.—The Committee on Brake-Shoe Tests thought last year that further tests should be made on account of new shoes being introduced. The committee subsequently found, however, that so many of the shoes now being presented are still in an experimental condition, and believed that further tests would not be wise until some of the shoes now on trial shall have demonstrated their efficiency in service and ability to continue in use.


N.° 150.
FERRO-CARRIL MEXICANO.
AVISO AL MAQUINISTA DEL TREN DE Carga DE BAJADA
Vía Libre.
con precaución al llegar á Esperanza.
Desde San Andrés
Hasta Esperanza
Llegó á las 6.40 pm
Salió á las 7.05 pm
Fecha Julio 23 - 1895
Firmado [illegible] Telegrafista
Firmado [illegible] Jefe de Estación
Firmado Uriarte Conductor

MEXICAN TRAIN ORDER.

The Gisholt Machine Company, of Madison, Wis., have issued two editions of a fine catalogue of their tools. One is in English, French and German, and is for the Paris Exhibition; the other is all English. Fine half-tones of their shops, lunch room, library and lavatories for the men are shown, as well as a number of striking illustrations of their tools at work and the work they turn out. A careful study of these will give practical information to any mechanic, and we would advise securing a copy at once.

Some Interesting Railway Statistics.

During the year, ending June 30, 1900, sixteen railway lines went into the hands of receivers, while thirty-nine were removed from such management. There was an increase in that time of nearly 2,900 single-track miles, which is the greatest increase since 1893. The total length of railway tracks in the United States at the time of the last report aggregates more than a quarter of a million of single-track miles.

There were 36,703 locomotives in service on June 30, 1899, or 469 more than the year previous. These were classed as follows: 9,894 passenger, 20,728 freight 5,480 switching, and 601 not classified.

The total number of cars was 1,375,916, an increase of 49,742 in this item over the preceding year; 33,850 of this number were assigned to passenger service, 1,295,510 to freight, and 46,556 to work-train service. Private cars are not included in the above.

The number of persons employed on the railways of the United States during the year ending June 30, 1899, was 928,924, an increase of 54,366 over the year before. From the classification it appears that of this number 39,970 were enginemen, 41,152 firemen, 28,232 conductors, and 69,497 other train men. There were 48,686 switchmen, flagmen and watchmen.

Wages and salaries paid out to employés this year aggregated $522,967,896, an amount of $77,459,635 in excess of that paid in 1895, and representing 60 per cent. of the operating expenses and 40 per cent. of the gross earnings.

The number of passengers carried during the year was 523,176,508, an increase over 1898 of 22,109,927. The number of passengers carried one mile—that is, passenger-mile—was 14,591,327,613, an increase in this item of 1,211,397,609. The tons of freight carried were 959,763,583, an increase of 80,757,276 being shown. The ton-miles were 123,667,257,153, an increase of 9,589,680,848.

That railroading is an extremely hazardous calling is proved by the figures, which show that one out of every 420 employés was killed, and one out of every 27 was injured. With reference to trainmen—including enginemen, firemen, conductors and other trainmen—one man was killed for every 155 employed, and one injured out of every 11.

Traveling by rail is remarkably safe; for the summary shows that only one passenger was killed out of every 2,189,023 carried, and one injured for every 151,998 passengers carried. This record gives 61,051,580 passenger-miles for one passenger killed, and 4,239,200 passenger-miles accomplished for each passenger injured.

A correspondent states that several cases of leaky dry pipe joints have been traced to reversing engine with throttle closed, the joints being strained by excessive pressure.

"Position is Everything," Even to Blocks and Tackle.

BY GEORGE S. HODGINS.

The rule for finding the weight which can be raised, or the pull necessary to lift a given weight, as given in the great majority of engineering pocket-books, if not in them all, is uniformly based upon a certain assumption. They will tell you, if you want to find the weight you can raise with a tackle having one single and one double block, that you must neglect the free rope upon which you pull, which is technically called the "fall"; and counting the remaining ropes, multiply the force in pounds, which you propose to apply, by the number of these ropes, and the result will be the weight which your force will balance. If you have a force of 10 pounds, and, as you will find, you have three ropes without the "fall," then with such a tackle you will be able to balance a weight of 30 pounds.

The assumption which is here made in the books which give the formula is, that when raising a weight from the ground, the double block shall hang from the ceiling, and that the single block shall be attached to the weight, as in Fig. 1. The rule holds goo'; a force of 10 pounds applied to the "fall" will produce a pull, neglecting friction, of 10 pounds in each of the remaining three subdivisions of the rope, and a weight of 30 pounds may be supported by tackle so arranged, while the ceiling hook will sustain a pull equal to 40 pounds.

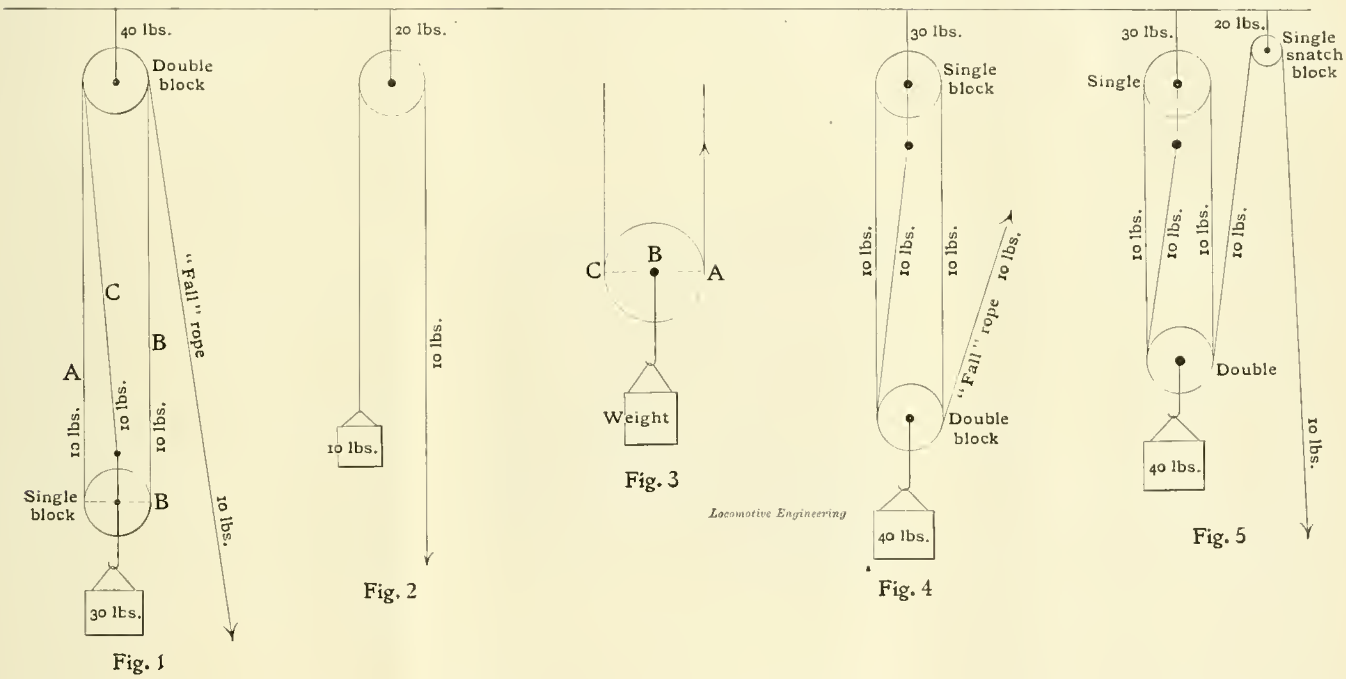
The reason why the assumption that the blocks will be so disposed as to place the double above and the single below, is probably because the act of pulling *downward*, in order to *raise* a weight, is generally accepted as the more convenient method.

In Fig. 1 the function of the upper or fixed pulley is to change the direction of the pull; that is all. A glance at Fig. 2, where one pulley is suspended from the ceiling, with one part of a rope passing up to it and the other down from it and holding a weight, will serve to show that no gain in power would result from such an arrangement. A force of 10 pounds on one division of the rope would only balance a weight of 10 pounds on the other, though the ceiling hook would sustain a pull downward of 20 pounds. The only effect which such an apparatus could produce would be simply the reversal of the direction of the pull.

When the lower or movable pulley (so called because it moves with the weight) is introduced, the real principle of the tackle becomes apparent. The movable pulley or pulleys are in reality levers of the second class, like the reverse lever of a locomotive, having the power applied at *A*, the weight supported at *B*, and the fulcrum at *C*, as in Fig. 3. In working out the rule for the lever of this class in this case, let us suppose that the diameter of the pulley is 8 inches. Then a force of 10 pounds applied acting upward at *A*, multiplied by the arm of the power—viz.: 8 inches—equals 80. The arm of the weight is here 4 inches, as the weight is supported from the center of the pulley, therefore the weight must be 20 pounds, because the weight multiplied by its arm must equal the product of the power multiplied by its arm. We have this equation: $10 \times 8 = 20 \times 4$. The movable pulley block is the one which supplies an infinite series of levers, as the wheel revolves, each diameter becoming, for the time being, a lever, each being quickly replaced by another and another, as the pulley turns over and over while rolling upward.

If, then, the upper or fixed pulley is only useful in changing the direction of the pull, and the movable pulley supplies the levers necessary to do the work, it is manifest that the greater the number of lower pulleys or levers which any tackle possesses, the more economical of power it will be.

With tackle having one single and one double block, there are only two arrangements of which it is capable. It may be arranged as in Fig. 1, with the double block as the fixed pulley, and the movable one the single. It may, however, be reversed, as in Fig. 4, with double block attached to the weight and the single block as the fixed pulley hanging from the ceiling. The pull will here be upward, but the "fall" rope will run direct to a pulley in the lower and lever-like movable block, and not to one which can only change direction of pull. This "fall" rope must therefore be counted as one of the subdivisions of the rope made by the movable block, and these subdivisions are the ones which operate levers and multiply power. In Fig. 4, 10 pounds pull will sustain a weight of 40 pounds, while the ceiling hook will carry only 30 pounds. It may be contended that to pull upward is not so convenient as to pull downward when raising a weight, and that contention will have to be admitted. In the consideration of the economical use of the power, the method illustrated in Fig. 4 is more economical of power over that shown in Fig. 1 in the proportion as 3 is to 4. The blocks as placed in Fig. 4 have every right to assert that in their case, as in many others, "position is everything." A modification of Fig. 4, as shown in Fig. 5, where a snatch-block hangs from the ceiling, fixed, for the simple purpose of reversing the direction of the pull, while it may add a little more friction, yet permits



ILLUSTRATING ACTION OF "FALL AND TACKLE."

of the more advantageous use of the tackle.

It is obvious that if a heavy weight had to be rolled or dragged along the ground, as when a derailed box car has to be pulled into position over the track, the correct position for the block which contains the most pulleys is next to the car, and with the fixed block containing the fewest pulleys securely fastened to some advantageous point, and the "fall" rope will run from the movable pulley direct to the coupler of the engine used by the "breakdown" gang. If this is done the maximum pull will be exerted upon the car, while the minimum will be applied to the fixed pulley, which has often, from the nature of the ground, to put up with more or less precarious hold upon rails, ties, or a handy, but insecure, stump.

The reasoning here employed has considered only the simplest case of the tackle, which contains one single and one double block; but it is equally applicable to all tackle—with double and treble blocks, or treble and quadruple blocks, or any number that may be used in combination. The point to be made in rigging tackle of any kind is to secure the greatest number of lever-like pulleys, and use the fewest number for the work of simply changing direction of pull. One is safe to say that this is best done when the movable block contains the greatest number of pulleys, and the "fall" rope comes directly from the lever-like pulleys. In this case it must be counted in as one of the subdivisions of the rope made by the movable block. The number so used can be correctly applied to the rule for finding either weight or power when one or other is known.

A very brief analysis of Fig. 1 may here be found to be profitable before leaving the subject. A 10-pound pull is exerted by the "fall" rope, and the fixed pulley above changes the direction and transfers the 10-pound pull into the outside rope *A*. In passing round the lower movable pulley it is acting on a lever, and so balances a weight of 20 pounds, the fulcrum at *B* traveling up rope *B*, puts a 10-pound strain on rope *B*. The direction of this pull is changed in passing over the second pulley in the upper fixed block, and is transformed from a downward pull in rope *B* to an upward pull in rope *C*, which being fixed to the center of the movable pulley, exerts no leverage, but only a direct upward 10-pound pull. Rope *A*, with lever-pulley and fulcrum at *B*, was found to be lifting 20 pounds, so that the total upward effort of the movable pulley is 30 pounds in all, and the ceiling hook is holding up 40 pounds.

A similar analysis of Fig. 4 will show a gain of 10 pounds over the arrangement of tackle given in Fig. 1. In wrecking operations on railways or in moving weights about the floor of a shop, where the engine, or gang of men, pulling is free to move in either direction with equal facility, the advantages of the arrangement of tackle as shown in Fig. 4 are too obvious to need further illustration.

Here, as in all other mechanical contrivances, the principle holds good that what is gained in power is lost in speed or distance. In Fig. 1 a vertical rise of 1 foot for the weight requires that 3 feet of "fall" rope be pulled out, and in Fig. 4 the same vertical rise of 1 foot would necessitate 4 feet of "fall" rope to be drawn through the pulley. Small power acting through long distance may be made to raise large weight through small distance, but both sides of the equation are always equal. In the arrangement of blocks and tackle it is quite evident that "position is everything."

Lame Engines.

It is not unusual to see locomotive repair shops fitted up with good machinery and modern appliances for doing good work, operated by skillful mechanics and superintended by officers who have the record for knowing how to do the repair work at a low expense, in a durable manner, and at the same time note that many of the locomotives are sadly out of square, as indicated by the sound of the exhaust, showing that interest in the matter of the proper distribution of steam to cylinders ceases when engines are in active service.

The particular province of the repair shop is to put the engines in good shape, and if they are not kept that way, they must be operated at a loss.

To the credit of our Railroad companies it can be said that the combination of good repair shops and lame engines is not so frequently found as some years ago, but there are cases yet to be found.

Good machinery and well-arranged shops lose part of their value if eccentrics work loose, eccentric rods get the wrong length or cut valve seats, or leaky cylinder packing allows the steam to get into the exhaust at the wrong time, before it has done its work.

If the sound of the exhaust is not pretty regular, it is an indication that some of the port openings are not right; but which one of them is wrong is more of a job to locate. We do not think it can be done by ear. The exhaust may beat as square as possible, and yet the matter of lead or lap can be so much out of the way that the engine will not produce the full power she should do.

Right here comes in the chance for the expert valve setter, who should be a practical man, who makes results the first consideration, and theory an aid to practice, instead of the leading feature.

The conditions under which the locomotives operate on different roads are so varied that what suits one road will not be successful on another. This accounts in a measure for the success of a certain design of valve motion at one place, and its failure at some other, where conditions are not the same.

The Traveling Engineers' Association are going to take up, at their meeting in September next, the question of a more extended use of the steam-engine indicator on locomotives, to locate defects in the steam distribution to the cylinders.

As this body of men are intensely practical, they are likely to look at the question on the practical side of it, and insist on results being got at in as direct a manner as possible, and with the smallest force of operators or observers that can secure the data necessary. They have a good chance to popularize the use of the indicator in locating defects in the distribution of steam, and we hope they will improve the chance. It may take more than one committee to work it out, but if they keep after it, satisfactory results will be obtained in the end.

White-Handed Toilers.

"People who work with their hands, especially farmers, are apt to think that professional men have an easy time of it," said a lawyer of this city. "It's an amusing mistake. The farmer stops at sundown and the laborer works ten hours at the outside. The average professional man works from twelve to fourteen hours, day in and day out, all the year around. Often, at a pinch, he will work from sixteen to twenty hours for several days in succession, and he will work when he is sick or suffering severe physical pain, something the manual toiler wouldn't dream of. Of course, he takes short intervals of rest, like everybody else. The human engine isn't capable of absolutely sustained endeavor for over an hour at a stretch. Watch a day laborer who seems to be plodding along like a machine and you'll find that he really rests more than half the time. He looks at some well-dressed doctor, lawyer, broker or man of affairs and says to himself: 'Oh! you doggoned lazy rascal! If you only had to work like me!' The truth is that the chap he envies is putting an amount of concentration and continued energy into his daily toil that would kill the man who works with his hands alone in less than a week. I don't mean this as any reflection on the laborer, who is also no doubt doing his level best. I simply mean that the demands on brain production are a third again as severe as the demands on muscle production. For sheer staying qualities there is nothing in the world that equals the nervous, high-strung, frail-looking modern professional man."—*Exchange.*

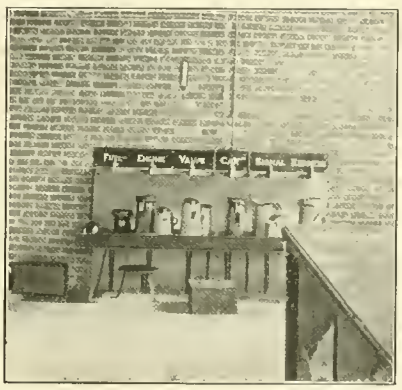
The seventeenth annual report of the Board of Railroad Commissioners of the State of New York for the year 1899 has just been received through the kindness of Mr. Frank M. Baker. It consists of two volumes, nicely bound in cloth, and contains a great deal of interesting railroad matter. The photographs and outline maps, showing the progress of work in the abolishment of grade crossings, are especially interesting.

Gage Glasses.

Water glasses give considerable trouble if they are not put in properly. One of the prominent makers of water glasses, John Moncrieff, of Perth, Scotland, gives us some hints on packing steam boiler water gage glasses that are worth paying attention to. He says:

"I have made a large number of experiments with the 'Perth' gage glasses which are manufactured by me. These glasses will stand a hydraulic pressure of 5,000 pounds to the square inch without breaking, and you may take one of them in your hand by one end and insert the other into a flame that will bring a red heat on it in about half a minute, also without breaking.

"Such being the case, the question naturally arises, why should a glass that will stand the variation of heat above described, and that can be subjected to 5,000 pounds hydraulic pressure, be broken with 200 or 300 pounds steam pressure? To this it might be replied that in the one case the tests are done separately, while in the other the heat and the pressure are combined. This looks like a formidable objection, but it is only so in appearance, as I am quite sure I will be able to prove that the glasses are broken neither by the pressure nor the heat, but by the expansion of the glass being interfered with.



A NEAT OIL ROOM. OIL FORCED UP BY AIR PRESSURE—CHICAGO & NORTHWESTERN, AT CLINTON, IOWA.

"Increased pressure of steam means increased heat, and the heat and pressure combined mean an increase in the expansion of the glass, and if the glass is packed too tightly, or in any way to interfere with its natural expansion, breakage is unavoidable. It must break the moment it reaches the point of resistance.

"In regard to the packing of gage glasses there are a number of points to be noticed; first, you must have a good gage glass. There are glasses in the market that will not stand 200 pounds pressure, pack them how you may; and the glasses must not be too full for the size of the gland. More glasses are broken from this cause than would be credited, if the amount were known.

"In the second place, the gage cocks must be set perfectly true, otherwise the glass will have too little space for expansion on one side; and the packing must be suitable and of the very best quality. Rubber washers of the best quality are not suitable of themselves; with steam at 200 pounds or more they get softened to pulp in a very short time and are blown out. To prevent this they should have a ply of asbestos twine or cord on each side of them, which protects them effectively.

"The next point to be noticed is the screwing up of the glands. You should be able to move the glass with your finger and thumb after the screwing is finished. If you cannot do so the room for expansion is not sufficient, and breakage will result. With the glass left easy there will be a little leakage when the steam is put on, but this will take up as soon as the glass and packing expand. To insure perfect safety, however, it would be as well to slacken the nut almost to leaking point again. One point to be particularly noticed is that the glass breaks most frequently at the steam end of the gage cock. That is because the steam is hotter than the water and causes more expansion. This should be kept in memory when screwing up the glands. If these directions are followed, a good gage glass should stand perfectly well in the highest pressure boiler that has yet been made.

"As the proper packing of a gage glass is so important to engine men, I may take the liberty of formulating these hints into a kind of rule:

"First, a good gage glass must be used, which should not be too full for the size of the gland; second, a good rubber washer should be used, protected by a ply of asbestos twine on both sides; and third, the glass should be movable by the finger and thumb after the glands have been tightened up. The steam end of the glass should be left a shade slacker than the water end, and in every case the steam should be turned on gradually; and last, but not least, the whole operation should be carried out with intelligence."

These "hints," as Mr. Moncrieff calls them, are very good rules to observe.

One difficulty with the water glass cocks on many locomotives is that there is no separate gland to compress the gasket alike on all sides; the gasket is put in the nut and turned around with the nut. This twists the gasket around so it is not of an even thickness and binds harder on the glass at one point than another. It is liable to leak at one side and crowd the glass hard at the other. To help this trouble, the nut should be cleaned out well; it helps the gasket to slip around if a little black oil or plumbago is put on the gasket next the brass.

What is said about the great amount of expansion breaking the glasses is readily understood if you notice a sight-feed glass in a lubricator. When the glasses get cold they shrink in size more than the brass nut outside the gasket and leak. If you then screw up the packing nut, when the glass gets hot it is liable to break, unless the gasket is soft enough to give and let the glass expand. For this reason you should use good rubber gaskets; poor ones or packing with clear asbestos tends to break the glass in short order.

A water glass that is set perpendicular is said to last longer than when set in an inclined position. Just why is not so easy to explain.

If there is a separate steam pipe, 24 to 36 inches long, connecting the top of the glass to the top of the boiler, instead of opening direct through the top cock into the boiler, the top end of the glass will last longer. Possibly this is because some of the steam condenses in this small pipe and supplies the glass with condensed water. At any rate, when connected direct to the steam through the top mounting, the glass corrodes and eats out thin in a few weeks; with the pipe the top lasts as long as any other part of the glass.

Storing Superheated Water.

We have received a prospectus of the Storage Power Company, of New York, showing their system of operating cars by stored hot water. This is said to be the invention of Mr. William Pratt, who has been experimenting in this line for a number of years. The plan is to store water at from 400 to 600 pounds pressure per square inch and admit a small quantity to the cylinder each stroke. This flashes into steam owing to the release of pressure, and drives the engine. They claim that 3,000 pounds of water will give 36 horsepower for one hour and drive a 60,000-pound car 40 miles in that time; but as they have calculated the resistance only 7 pounds per ton, it is needless to say they are in error.

For the past twelve years the firms of Robert W. Hunt & Co. and Hallsted & McNaugher, and the latter's predecessors, G. W. G. Ferris & Co., have been associated as consulting engineers, inspectors of rails, structural and bridge materials, locomotives, cars, machinery, etc., each conducting their own business under their respective firm names. That the interests of their clients may be even more fully protected, it has been decided to merge the two firms into one organization, to be known as Robert W. Hunt & Co., the partners being Robert W. Hunt, John J. Cone, A. W. Fiero, James C. Hallsted and D. W. McNaugher. The firm's offices will remain at 1121 The Rookery, Chicago; Monongahela Bank Building, Pittsburgh, Pa., and 71 Broadway, New York.

Our new book, "The Compound Locomotive," will be ready about August 25th. This is a book especially for practical men. $1.00.

Almost a Wreck.

I had lost track of Pat Wallace since he left the service of the Monterey & Mexican Gulf Railway, so when I met him I asked him what road he was connected with. He replied that he was running a passenger train out from the City of Mexico on the National Railway, on what is called the Mountain division, the most dangerous piece of railroad to run on in the republic. The road crosses a mountain which is 10,020 feet above sea level. From that point the road drops down over 2,700 feet in a distance of 15 miles, and only an engineer with a cool head and an iron nerve will undertake to haul a train up and down that mountain. While he was describing it Jack O'Leary, the "Duke of Cork," who was one of the party, and who is one of the most popular railroad conductors in Mexico, asked if he ever had an accident on that division. Pat gave us his experience as follows:

"When the Southern Methodist ministers' excursion party visited Mexico I was detailed to haul them across that mountain, as the company would not entrust their lives in the hands of any other engineer in their employ.

"As I was given the right of way from the city to Acambaro, and in order that the excursionists could get a good view of the valley of Mexico from the summit, we pulled out at 8 A. M.

"As the morning was bright and clear, not a cloud in sight, the tourists got a grand view of the mountains beyond them and the city and valley below. It was a glorious morning and the scenery was enchanting; just such a morning and scenery as exists nowhere else in the known world. Everything went along smoothly until we commenced to descend on the north side of the mountain. All the brakemen were at the wheels, and I felt that we would reach the lower level all right. All at once I felt the engine give a lunge forward; I tried the air brakes, and to my horror they would not work. I then called for brakes, and kept it up, but the brakemen were powerless to check our speed. We rushed downward and downward, faster and faster, and I was powerless to check our mad rush. I then thought of Mary and the boy. Oh, what would become of them if we were wrecked and I was dashed to pieces? This nerved me to put forth all the strength and knowledge I had to stop the train. I kept calling for brakes, but by this time the train was going at the rate of 80 miles an hour, then 90 and 100. I then prayed to Almighty God to save us, but downward the train plunged, increasing in speed at every turn of the wheels. I looked back and could see a streak of fire on the rails, which was caused by the wheels sliding on them. Again I thought of Mary and the boy and of those ministers who were on that train. If we should be killed, Mary and the boy would be left widow and orphan, while thousands of Mexican Catholics whom those ministers came here to convert would die in their sins, and they would be everlastingly damned. When I thought of that I again prayed to the Virgin Mary to intercede for us. By this time the perspiration was oozing out of every pore in my body; my blood refused to circulate, my muscles were becoming as hard as bars of steel and my eyes began to bulge out of their sockets. By this time the train was going at the rate of 200 or 300 miles an hour. I looked ahead and I could see that we were approaching a sharp curve on the side of the mountain. I knew that when we struck that curve at the rate of speed we were going that the train would be pitched head foremost down to the bottomless pit, and that all would be lost. I then thought of Mary and the baby and I screamed out loud, and prayed to God, the Virgin Mary and St. Patrick to have mercy on my poor soul and to provide for Mary and the baby."

While he was relating the above bloodcurdling narrative the perspiration was pouring out through his forehead and rolling down his cheeks. When he stopped to take breath, Mr. Horace asked him how he stopped the train and got out alive. He replied:

"When I offered up that prayer Mary struck me in the ribs with her elbow and remarked: 'Pat, phat the divil's the matther wid ye? If yez don't sthop that darn prayin' and shoutin' you'll wake the baby.' That punch in the ribs woke me up, and I jumped out of bed and looked all around the room for the ministers, and behold! I was only dreaming!"—E. Levan, in *Orange Leader*, Texas.

Those who are interested in the lighting of passenger cars should send for a copy of the "Little Talks" just issued by Mr. John W. Abbott, of the Consolidated Railway Electric Lighting & Equipment Company, of 100 Broadway, New York. It tells in an interesting manner the way in which their system operates and its advantages.

The rapid strides which mechanical draft is making as a substitute for chimney draft are well exemplified by the statement recently made by the B. F. Sturtevant Company, of Boston—the pioneers in the introduction of the fan in the place of a chimney—to the effect that their sales of apparatus for stationary boiler plants were last year over three times those for the year before, and that they now amount to nearly 1,000 horse-power per day, about equally divided upon stationary and marine plants. It is also interesting to note that in a number of the technical schools of the country experimental mechanical draft apparatus has been installed principally for the purpose of instruction, and that numerous graduating Theses are concerned with the investigation of this subject.

Pumping.

BY A. G. KINYON.

In this day of close economies on railroads, and the appreciation by the officials of the work of an employé who practices economical ways of doing, as evidenced by the showing made, the careful and proper pumping of the locomotive boiler, as a factor to this end, is not given near the consideration it should have by the locomotive engineer.

We can almost hear the storm of denunciation and denial which this statement will call forth from a certain class of men, but must say that we candidly believe such will come only from those to whom the statement applies, and sincerely hope they will bear with us until we have explained the matter more at length. If they be fair minded, we believe they will admit that nothing but facts have been stated, and will see the errors of their ways and possibly make a change in their way of doing, to their own as well as the company's advantage.

Of this class of men there are a great many for whom there is an excuse for their present way of handling the injector in the fact that, when pumps were used altogether as a means of supplying water to locomotive boilers, while the engine was moving the pump was at work, and when the engine stopped the pump stopped also, being coupled to the crosshead. This condition leads to two others, when water is supplied by injectors, which may, at first thought, appear necessary to the old-timer, but are in fact in direct opposition to a practice which brings good results.

The first of these is the practice of so many men not shutting off the water (injector) when pulling out after making a stop, and causing the steam pressure to be knocked back so far that it requires the greatest effort on the part of the fireman to get her hot again, and he only succeeds in so doing, if at all, about the time another stop is to be made. When the throttle is closed the safety valve opens and as much water goes out the pop as the injector is putting into the boiler, and as soon as the throttle is opened again, the cool water introduced during the stop is put into circulation throughout the boiler. Back goes the pointer on the steam gage and the fireman again commences his exertions to bring the pressure to the proper point, and so on to the end of the chapter.

It has been the observation of the writer that men who pump an engine in this manner are also the ones who leave the reverse lever in the corner for *several hundred feet* when pulling out of a station with a light train. This requires very heavy firing to keep any fire in the firebox, which causes dense clouds of black smoke and incites the passengers or the public to unkind remarks, and is also a visual evidence of the engineer's lack of skill in managing this part of his work.

This way of doing still further reduces the steam pressure to a point where it is necessary, when he does finally "hook her up," to work the engine a notch lower than otherwise would be the case, thus wasting fuel in a twofold manner.

It is the writer's belief that if these men would "hook her up" sooner when pulling out of stations they would find they attained a high rate of speed much quicker. A few words in explanation of this belief will perhaps tend to convince anyone of the error of the practice, though it is doubtful if men who handle their engine in this manner will admit that they do; always thinking it is the "other fellow" who makes the mistake. Now, by way of illustration, we will suppose that we have a large tank full of water which we desire to empty by dipping it out with a quart measure. If it be a large tank, it will require a great many dips with a quart measure, but if we were to get a gallon measure with which to do the work, the supply would last only one-fourth as long. So it is with dipping out the steam from a locomotive boiler by either nearly a cylinderful at a time, as is the case when working full stroke, or by a quarter of a cylinderful at a time, as is the case when running with the reverse lever hooked up near the center. If the first way is taken, it is quite obvious that the drain on the boiler will be severe and that the extra exertions on the part of the fireman before referred to will be necessary, with all the attendant detrimental effects, and then not be successful; while, if the other way be followed, the supply of steam is not drawn upon so heavily. It is not necessary to force the fire and then make black smoke in the effort to keep up the pressure, and the lighter exhaust does not tear the fire, but allows of carrying a fire at all times which will approach nearer the ideal condition for a perfect combustion, namely, a bright, clean fire, allowing of firing with but one or two shovels of coal at a fire and little, if any, black smoke. The holding up of the steam pressure to the limit and expanding it in the cylinder from point of cut-off will get the train moving much faster in a given distance than full stroking her for the same distance, as the pressure is knocked back by the drain on the boiler, and a back pressure is formed by the inability of the steam to get out of the cylinder in the time given. Added to this is the necessity of working the injector harder to make up for the needless waste of steam.

Now for the second condition before referred to, which is the reluctance of many men to putting large quantities of water into the boiler when running shut off or while standing still. The belief prevails that this practice is detrimental to the flues and firebox seams, causing them to leak by contraction due to the chilling effect of the large quantities of cold water introduced in the absence of the forced draft in the firebox and through the flues. This idea was so prevalent and fixed in the days of the old-timers that they would shut the pump off when running shut off for any distance, regulating the pump so it would just supply the boiler when working steam; it being the boast of many such men that they could tie a string around their water glass at a certain point and not have their water level vary half an inch either way from it over the division on any kind of a run. But the writer has no recollection of ever hearing them state how the steam pressure acted, a thing of much greater importance. But this idea has long been exploded, the best evidence of which is the almost general practice by the railroads of washing locomotive boilers immediately after steam has been blown off and the water let out, and the work then done with cold water, with no evil results.

The advantages gained by a different way of handling the water supplied are so great and obvious that we confidently believe no intelligent engineer can fail to appreciate their value when once pointed out and explained.

To begin with, the boiler of the modern locomotive has been increased so much in water and heating space, that it is not necessary to maintain a fixed water level so closely as it formerly was, in order to be above the danger line at all times; and in addition to this, the modern injector has been brought to such a state of perfection that it may be relied upon to go to work at once when wanted, especially if a little attention is given it by the engineer in keeping all feed-pipe joints tight and having it limed out at proper intervals. Under these conditions the engineer is able to start out with a full boiler of water, which represents a large amount of stored heat-units, which may gradually be drawn upon after once starting, thus allowing of an adjustment of the injector feed by which water is gradually lost, when, upon shutting off steam, there is ample room in the boiler to allow of both injectors being put to work to fill it up before it is necessary to work steam again.

This enables the fireman to keep a nice, bright fire burning all the time, so that all that is necessary to keep up a steady steam pressure is for him to put in a few shovels of coal before the engineer shuts off the injector and commences to work steam again. The practice of many of our superintendents of motive power, of putting both injectors on the right side of the engine, is a great help to this kind of boiler feeding, and is done for that purpose. In the absence of this arrangement it should be the duty of the fireman to pump the engine, and the engineer should put the right injector on when it is desired to have them both at work. In this way the most of the water, especially on short-stop runs, can be put in while running shut-off into stations; and on freight trains, this being especially true on hilly divisions, a great saving of coal can be made by this way of pumping, and an engine can be run trip after trip without having the steam-pressure vary 10 pounds and without the pops ever lifting. Another point in favor of this practice is, that both injectors are brought more or less into constant use, and are thus not allowed to become out of order and useless, as is sometimes the case when but one is used.

Now, we do not mean to say that all of the old engineers pump wrong, and all of the younger ones pump right. No; far from it, as we know of many old-timers who are artists with the injector and young ones who are as rank as the rankest; but we do say that the majority of the poor pumpers are among the older men, for the reasons before given, and that all runners can find something to improve their way of handling their water supply if they will give the matter a little more thought and study.

In conclusion, we wish to state that, everything else being equal—that is, engine condition, time made, ability of fireman, quality of coal, weather, etc.—the man who follows this system of boiler feeding will be far ahead on the performance sheet at the end of each month.

One of the neatest catalogues we have seen lately is "The Book of the Brotherhood Overalls." In it our friend Peters tells where he railroaded, how he started making overalls, and how he has built up his present business by persistent efforts to make nothing but first-class goods. It is well illustrated, and will interest anyone. A copy can be had by addressing H. S. Peters, Dover, N. J.

The Joseph Dixon Crucible Company, Jersey City, N. J., have issued a little pamphlet about the merits of their silica-graphite paint for structural steel and tin roofs. It also gives specifications for the use of this paint, and shows illustrations of the American Exchange National Bank Building and the Broadway-Chambers Building, two recently constructed buildings in New York, the steel work of which is protected with the above paint.

One of the advantages of the new Leach triple sander is that it allows the sand box to be placed in the most convenient position. On some of the big engines it could change places with the bell, to the advantage of the latter. A bell, to be of most value as a warning agent, should be ahead of the cab, and this device allows the sand box to be located at will.

The Weber Gas & Gasoline Engine Company, of Kansas City, Mo., have issued a new 72-page catalogue of their engines. Aside from advertising their engines, it gives considerable information about gas and oil consumption and other data that practical men are interested in.

The Corliss Jigger.

One of our friends from Taunton, Mass., wants to know if anyone can remember the engine named the "Advance," built by the late George H. Corliss about 1851, and which had four valves to a cylinder? This engine was called the "Jigger" by the men on the road.

A writer in the Milwaukee *Sentinel* mentions a startling incident that happened to a locomotive belonging to the Chicago & Northwestern. The whistle valve broke on a Sunday morning just as the engine was leaving Chicago, and it was run to Milwaukee, a distance of 65 miles, with the whistle screaming all the time. Must have been a fine steaming engine.

The Northern Pacific Railway Company have specified Bethlehem nickel steel for the driving axles and crank pins for twenty locomotives now under contract with the Schenectady Locomotive Works, and the Bethlehem Steel Company have already booked orders for the forgings in question. They report that the list of railroads using this material is steadily growing, but call attention to the fact that those wishing to specify it for locomotive forgings should be careful to designate it as "Bethlehem nickel steel," as the reputation gained by it has resulted in the production of inferior imitations which do not show the same high qualities.

In a first-class carriage, in Germany, an Englishman was observed to be constantly putting his head out of the window. The train was going fast, and a sudden gust of wind blew off his hat. He at once took down his hat-box and hurled it after his hat. Then he sat down and smiled on his fellow passengers, but, of course, did not speak. The Germans roared with laughter, and one of them exclaimed: "You don't expect your hat-box to bring back your hat, do you?" "I do," said the Englishman. "No name on the hat—full name and hotel address on the box. They'll be found together, and I shall get both. Do you see now?" Then those Germans subsided, and said they always had considered the English a great and practical nation.

Mr. Henry Breitenstein, of Laramie, Wyo., has invented a device for operating a turntable with compressed air. The motor which does the work is suitably located on the table and may receive its supply from either a separate and stationary tank on the table, or from the main reservoir of the locomotive to be turned. The latter source is perhaps preferable, except in cases of dead engines, or those having very low pressure. The table may be turned in either direction. Persons desiring more detailed description or other advice concerning the invention will doubtless be accommodated by writing the inventor.

Indian Crows Railroading.

The Chicago, Burlington & Quincy Railroad is building a line in Montana down into the Big Horn Basin toward Yellowstone Park, and as the Crow Indian reservation is near at hand, a contract has been made with the red men for grading a section of roadbed. The managers of competitive lines threaten to enter a complaint to the Western Passenger Association, making the charge that the Burlington has made a deal with the "scalpers."

One of our subscribers in the West suggests the forming of a "Society for the Prevention of Cruelty to Railroad Men," its first mission being the suppression of such stories as "The Night Run on the Overland" that appeared in a recent issue of McClure's Magazine.

The second largest cylinder ever made in Scranton, Pa., was turned out a short time ago by the Dickson Manufacturing Company. It weighs 52,000 pounds, has an 88-inch bore and a 5-foot stroke. The cylinder complete, with flywheels and heads, weighs 354,000 pounds.

A recent dispatch from Berlin to the New York *Sun* said that the reduction in the price of steel made in the United States had caused a panic in the Berlin bourse and that industrial shares fell from 10 to 15 per cent. That was an acknowledgment that the United States regulates the price of steel for all the markets of the world.

The Pyle-National Electric Headlight Company, of Chicago, have just issued a small instruction book, which relates principally to the care and operation of their headlights, but it has a short chapter on the A B C facts of electricity that is well worth reading. The use of electricity for lighting in railroad service is becoming so general that railroad men will soon find it necessary to learn some of the theories of the operation of electric current in order to be up to date when they are expected to learn of the operations.

The Carnegie Steel Company, Pittsburgh, Pa., have issued their 1900 catalogue of standard steel rails and splice bars. It shows the exact shape of both rails and fish plates, gives proportion of head, web and base and the names of roads using the different weight rails of this company.

The International Brakeshoe Company, whose offices are in the Old Colony Building, Chicago, have been awarded the Silver Medal at the Paris Exposition for their exhibit of the Diamond "S" brakeshoe for locomotives and cars. The Silver Medal is the highest award given for this class of railway appliances.

Queer Boiler Purger.

At Evansville, Ind., some of the stationary engineers put a lot of horse manure into the boilers each time they are washed out—not for the purpose of stopping leaks, as is the practice with locomotives, but to prevent the formation of scale. Some of the boilers in which this purge has been used for a good many years are still as clean as when new. The boilers do not foam.

The diamond ring subscribed for by the members of railway associations which met at Saratoga in June, was presented to Mr. Bowen R. Church, leader of Reeves American Band, on July 14th. The willingness of Mr. Church to accede to requests for special selections has made him very popular at these conventions, and it is to be hoped he will continue to engineer the musical programme for us at conventions.

The Walworth Manufacturing Company wish to notify their friends that they have moved their New York offices to rooms 807-808, Park Row Building.

There is no truth in the statement that all men on the Baltimore & Ohio Southwestern over forty-five are to be discharged.

The Gilman-Brown emergency knuckle for holding cars together when the knuckle of a Master Car Builders' coupler fails, is growing rapidly into favor among railroad officials. The Big Four people recently ordered a supply of these emergency knuckles for all their freight train way-cars, and other roads have taken similar action.

The Pennsylvania Railroad have a few miles of nickel steel rails in use in the steep grade west of Altoona. The surface of the rail is much harder than that of common Bessemer steel, and the engineers say that the engines slip more on it than on the common steel. This is likely to be the case, but the tendency to slipping is increased by the contour of the nickel steel rail being different from the Pennsylvania standard rail.

The Q & C Company, Chicago, Ill., have put upon the market the Torrey ballast car, invented by Mr. A. Torrey, chief engineer of the Michigan Central Railroad. This car is one of the most useful appliances designed for the distribution of ballast on the track with small delay of trains. The ballast is delivered at the sides of the track, and therefore no immediate attention is required to prevent contact with brake beams or to clean out crossings and flanges to prevent derailment, as in the case of most other ballast delivery cars. The Q & C Company have issued a descriptive circular regarding the car, which will be supplied to anyone making application.

Locomotive Engineering

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A Fast Train in New England.

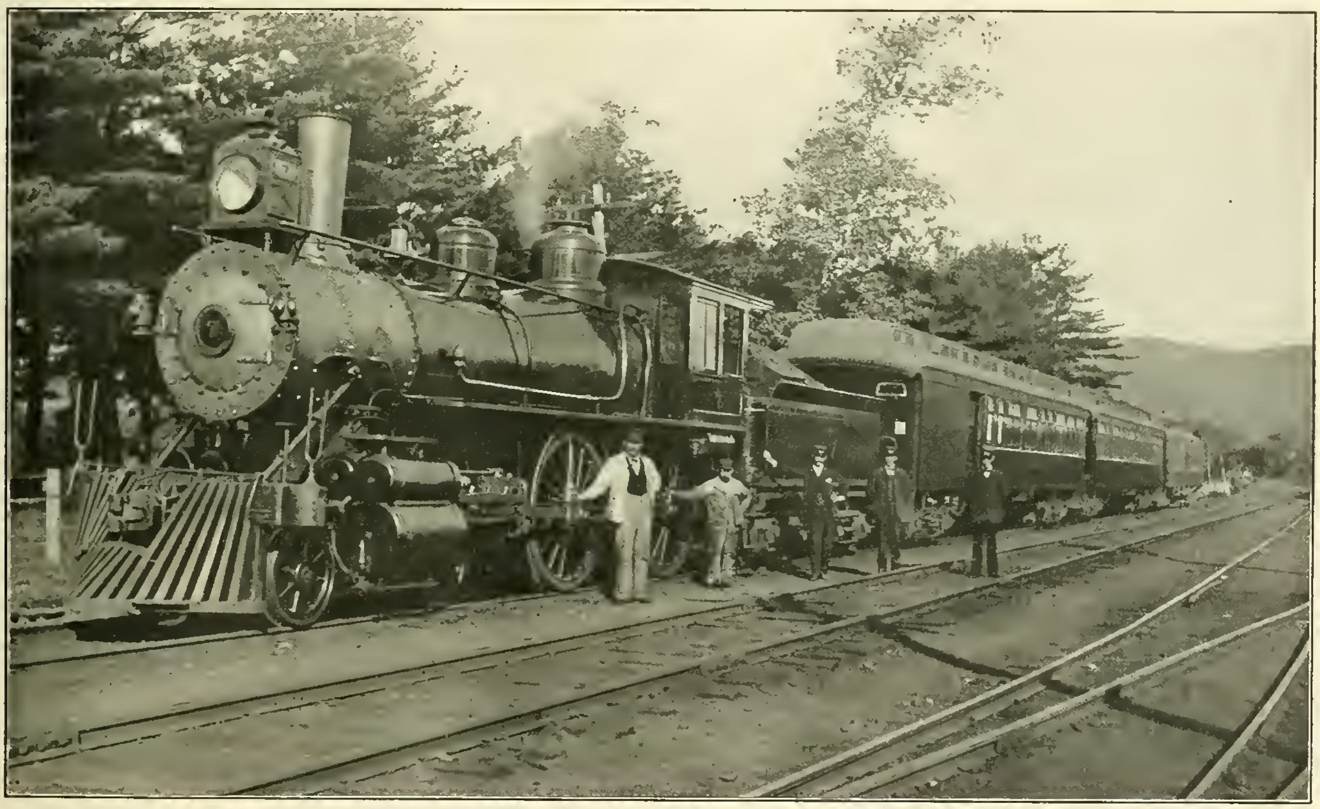
It is quite a surprise to find a fast train on a small road up among the Connecticut hills, but this one is entitled to considerable credit when all the conditions are considered. It runs from Hartford to Canaan, a distance of 55 miles, and while the time is 90 minutes one way and 95 the other, there are eight stops, three grade crossings of railways (which practically require a stop), and several slow-downs for sharp curves.

A profile of the road shows almost no level ground, and there is 11 miles where the grade is from 66 to 100 feet to the mile—about 4,000 feet of the latter. There is one place near Hartford where 80 miles an hour is made for about 5 miles.

The train consists of three special Pullmans, weighing 170,600 pounds (total), and with the 174,000 pounds of engine and tender, bring the total up to 344,600 pounds.

The engine is a 12 and 20 by 24-inch Vauclain compound, 180 pounds of steam, 69-inch wheels, which carry 67,000 pounds of the weight of the engine.

The train is the Mountain Express of the Central New England road, and Master Mechanic Shaefer calls attention to the relative sizes of Engineer William Ahearn and Fireman Joseph Kegler. The photograph was taken at Canaan by H. G. Reed, ticket agent at that place.



MOUNTAIN EXPRESS ON CENTRAL NEW ENGLAND RAILROAD.

Test of the Siberian Railway.

The great Siberian Railway is just now being severely tested by the Russian Government in the hurried shipment of troops and ordnance to the war section in China. The railway has been hastily constructed, and without the usual interim in which to bring it up to the required standard for heavy and fast service, it finds itself subjected to perhaps as severe service as it ever will, for troops and ordnance require rapid transportation in time of war. It is reported that, on account of the rough condition of the track, the speed of troop trains is compulsorily reduced to five miles per hour on many sections. The faults and weaknesses of the hastily constructed line seem to come rapidly and plentifully to light under the unexpected and sudden strain of troop moving.

It is reported that personal negotiations between the Czar and Emperor William have resulted in an arrangement whereby German troops are being transported to China by way of the Russian and Siberian railways. Smaller bodies only will be sent by rail, the larger bodies going by sea.

Increased Orders for Steel Rails.

A large number of new orders for steel rails for speedy delivery have been placed by the railroads throughout the country. Extensions and branches are being constructed into several new industrial regions in the West and South. Some of the railroads are now laying rails which they bought two and three years ago, when steel was so temptingly cheap. President Huntington said that the Southern Pacific then bought more than 170,000 tons of metal and now has about all it needs.

Equipping the Czar's Railroad.

The Trans-Siberian Railway is actually being built in the United States, for the contracts for its equipment have been given to American firms. Carnegie and the Maryland Steel Company are supplying the rails. The Baldwin Locomotive Works have worked night and day turning out locomotives for the Russian road. The Pressed Steel Car Company are supplying freight car bodies, and the Westinghouse Air-Brake Company are furnishing the air brakes. The steel bridges are made at Sparrows Point, Md. Stationary engines and other machine-shop equipment have been made in Pittsburgh, Cincinnati, Schenectady and other American cities. Altogether, this means the employment of an army of American workmen and the influx from Europe of many thousands of dollars. Hence, the Czar's road is actually American built.

English railway companies do not pay their employés as high wages, but they take a closer personal interest in their people than what is taken by American railroad officials. The son of a British railway "servant" is always given preference over others for employment, and numerous minor favors are given that tend to maintain cordial relations between employers and employed. This was noticed at Crewe, the mechanical headquarters of the London & North Western, a few weeks ago. On the completion of the four thousandth engine at these works the directors gave all the employés a day's holiday without loss of pay. There are 8,000 men employed in the works, so the generous action of the directors represented considerable money. There was a great deal of festivity in connection with the holiday, and the freedom of the city of Crewe was conferred upon Mr. Webb, the locomotive superintendent.

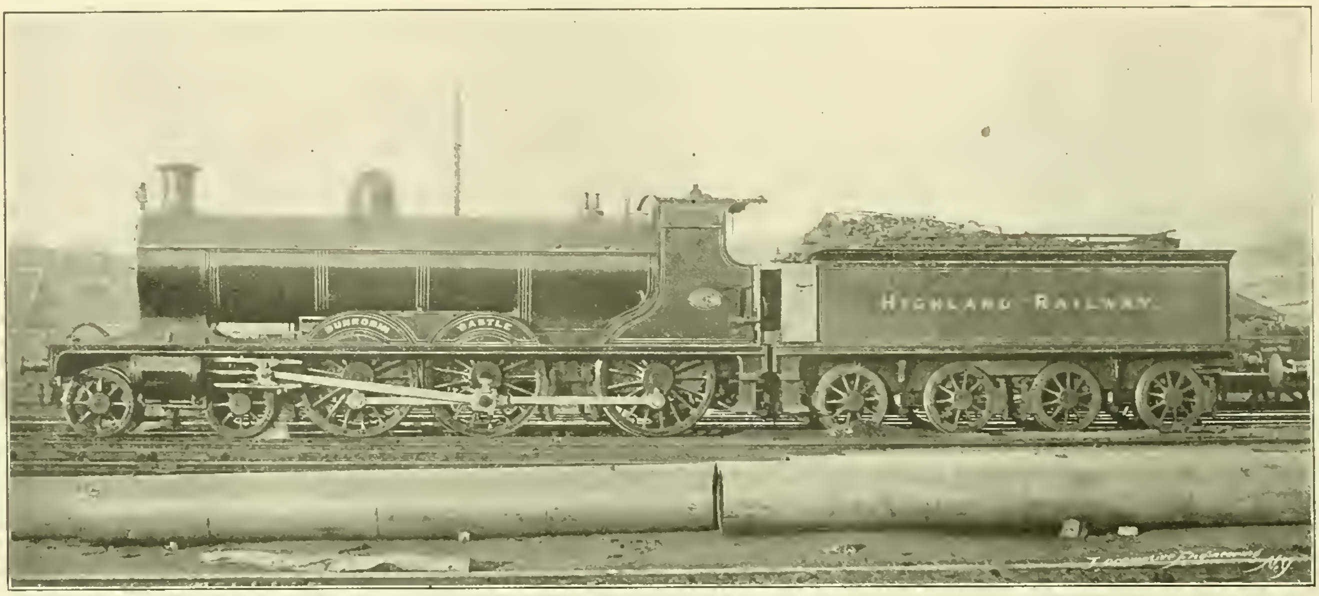
New "Highland" Locomotive.

We are glad to show an engraving of the latest express passenger engines for the Highland Railway, sent us by Mr. Sam. A. Forbes, of Perth, Scotland, as well as one of the older engines. These locomotives, which are the largest in Great Britain, show a remarkable advance in size and power on any others in the country.

The small inside-connected engines designed by Mr. Drummond in 1898 having proved quite incapable of handling the fast heavy trains, the directors resolved on an enlargement of the "103" class of ten-wheel goods engine built in 1895, and illustrated in our January number of 1896.

The order was placed with Messrs. Dübs, Glasgow, who have built the six engines which comprise the "Castle" class.

The main line of the Highland Railway, from Inverness to Perth, is an exceptionally trying one. Starting from sea level at Inverness, it rises on a ruling grade of 1 in 60 and 1 in 65 for 22 miles to the Slochd Mhuic summit, 1,320 feet; thence falls on slightly easier grades to Kingussie, 600 feet. From Kingussie the rise to the Pass of Drumochter, 1,484 feet, 65⅛ miles from Inverness, is made. From the summit the fall is very rapid, 1 in 70 for practically 30 miles to Blair Athole, afterwards with several short, stiff banks to Perth, 118 miles. Following are list dimensions and comparison with Mr. Drummond's engines built for the same service, and which show a remarkable contrast.



NEW TEN-WHEEL EXPRESS ENGINE FOR HIGHLAND RAILWAY, "CASTLE" CLASS.

TYPE.	"BEN" CLASS. Inside Cylinder, 4 Wheels Coupled.	"CASTLE" CLASS. Outside Cylinder, 6 Wheels Coupled.
Driving Wheel, diameter	6 feet	5′ 9″
Cylinders	18¼″ x 26″	19½ x 26
Steam Ports	. . . .	16″ x 1⅝″
Exhaust Ports	. . . .	16″ x 3¼″
Slide Valves	Ordinary	R'chdson balanced
Reversing Gear	Steam	Steam
Valve Gear	Stevenson	Allan straight link
Bogie Truck	Adams	Adams
" Wheels	3′ 6″	3′ 3″
" " Centers	6′ 6″	6′ 6″
Boiler, length and diameter	. . . .	14′ 4½″ x 5′ outside
" number and diameter of tubes	1¾″	248 2″ outside
Firebox, length and width	. . . .	8′ 5′ 1¼″
" depth at back	. . . .	3′ 11¾″
" " front	. . . .	5′ 3¾″
Grate Area	20 3/10 sq. ft.	26½ sq. ft.
Height of Boiler, center line	7′	8′ 2″
Heating Surface Firebox	115 sq. ft.	148 sq. ft.
" " Tubes	1060 "	1916 "
Total	1175 sq. ft.	2064 sq. ft.
Weight in Working Order	46 tons	58 tons 17 cwt.
Pressure	175 lbs.	180 lbs.
Tender	Six wheel	Bogie
Wheels, diameter	4′	3′ 6″ and 6′ 6″ centers
Bogie Centers	. . . .	11′ apart
Water and Coal	{ 3000 gallons { 240 cubic ft.	{ 3350 Imp. gallons { 260 cubic ft.

Early Locomotive Building in Massachusetts.

BY HERMAN L. MORSE.

THE ESSEX MACHINE SHOP.

In the eight years preceding 1855 there was probably a very great demand for locomotive engines, as most of the machine shops in the New England States with tools of sufficient capacity engaged in constructing them.

The Lowell Machine Shop, the Amoskeag Manufacturing Company, of Manchester, N. H.; the Mason Machine Works, of Taunton, Mass., were some of those who added this to their regular business. Of these shops the writer hereof has no special knowledge. Among those who made locomotive building a "side issue" was the Essex Machine Shop, of Lawrence, Mass. This city was promoted and given life by a corporation known as the Essex Company, who built the dam across the Merrimac River and constructed the canal and locks. As one of their enterprises the same company built an immense machine shop, 400 feet long, 60 feet wide and four stories high. The building was of stone, was warmed by steam and lighted by gas; for in those days many of the hours of darkness in winter and nearly the whole of the daylight in summer were devoted to labor. The building is now used as a cotton mill by the Everett Mills. Three of the floors were devoted to ironwork and the fourth to patternmaking and other woodwork. In addition to this there were a large foundry, a blacksmith shop with about twenty forges and a large boiler shop. The machinery for all these was driven by water-power, two large turbine water wheels being employed. The machinery and tools were the best of the time. Some of the larger machines were built in England. I recall in particular a "spliner" or slotting machine, the tool head having a vertical stroke of 6 feet, and a planer of about 10 feet platen with a revolving tool head for cutting on both the forward and backward motion of the platen. All of the planers—some of them having been made in the shop—were driven by screws instead of the almost universal rack and pinion of the present day. The smaller lathes were made in the shop, the rest feed being by a chain which was a mammoth imitation of bicycle sprocket chain of the present.

The superintendent was Mr. Caleb M. Marvel. The various departments of work were in charge of foremen who were called "job hands," who generally had the work by contract at a fixed rate, but who sometimes worked by the day. The "job hand" who was put in charge of the lighter parts of the locomotives was Mr. Aretas Blood, whose fame as principal owner and manager of the Manchester Locomotive Works is nearly world-wide. From the profits of his contract work at the Essex shop he was able to be one of the original proprietors of the works at Manchester, which by his skill and perseverance became the leading locomotive shops in the country and made him the millionaire he was at his death, a few years ago.

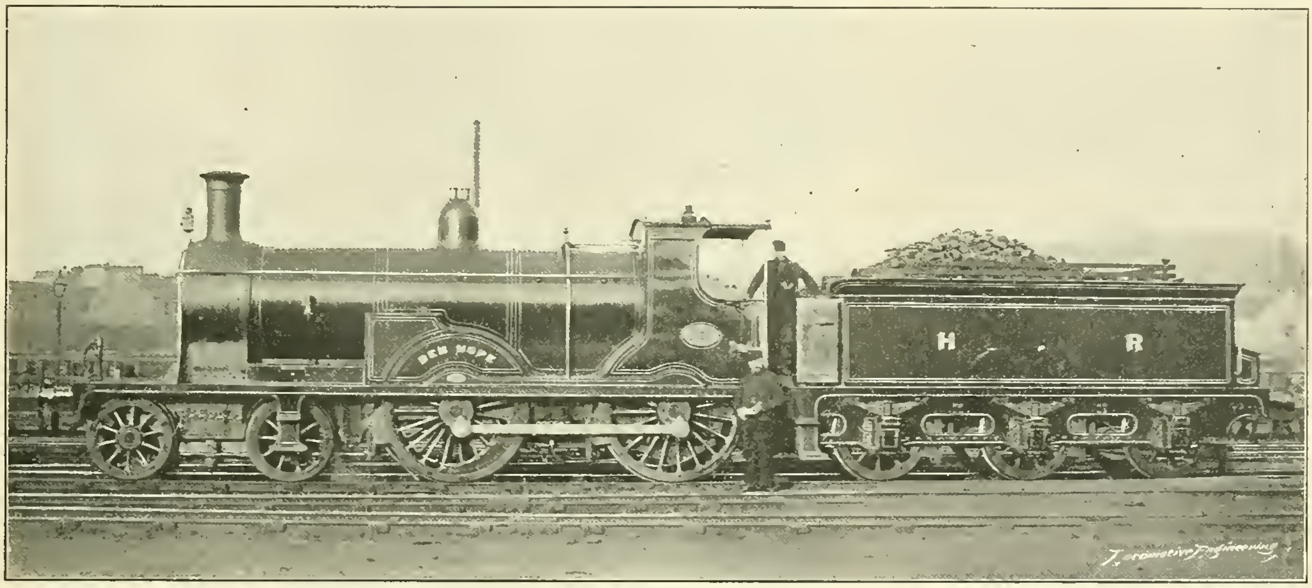
The erecting of the engines was in charge of Mr. Cephas Manning, who was afterwards, in 1855 or 1856, master machinist for the New Albany & Salem Railroad in Michigan City, Ind., and, I think, later at one of the shops of the Hudson River Railroad. Of the number of engines built by the Essex Company, or where they were operated, the writer has no information or memory.

HINKLEY & DRURY.

The date when this firm began to build locomotive engines is unknown to this writer. My first knowledge of them was in 1847. It is probable they were the first builders in New England, and perhaps commenced that branch of engine building before 1840. The original name of the firm was as above written, but before 1850 they were known as the Boston Locomotive Works; Holmes Hinkley, president; Daniel F. Child, treasurer; Gardiner P. Drury, superintendent. At that date the personality of the founders of the concern was greatly in evidence. Mr. Hinkley seemed to be a dignified and rather reserved gentleman, a little more distant from the working force than Mr. Drury, who was familiarly known as the "Deacon," as he held that office in one of Boston's churches.

The "Deacon" was an impulsive and warm-hearted man, and had withal a rather quick temper. Many stories were told illustrative of these traits. The foreman of the shop was Edward T. Troffitter, who was hardly so popular with the "hands" as was his assistant, Mr. John Daniels, who had been with the firm from the beginning. Mr. Daniels in some ways resembled Mr. Drury, and was fond of telling how he had been three times dismissed from the employ of the firm by the latter and immediately re-employed each time by Mr. Hinkley without any solicitation on his (Daniels') part. Mr. Hinkley had a son, James F., who was at the works as draftsman, but he died while still a young man. The machinery of the shop was of a very primitive description, all the large lathes having wooden beds and chain feed; some of the smaller lathes had iron beds.

The drill presses were of the rudest construction. A wooden frame bolted to the ceiling with a vertical shaft provided with a socket and set-screw at the lower end, had a rotary motion by means of bevel gears, and a vertical or feed motion produced by a rack and pinion. On the pinion shaft, which was within 2 feet of the ceiling, was a large sheave with an endless



ONE OF THE "BEN" CLASS—INSIDE CONNECTED—HIGHLAND RAILWAY.

rope falling within easy reach of the operator's hand. The feed was often made automatic by attaching a weight to the descending part of the rope. The work was placed on the floor or on a movable table; thus the capacity of the machine as to size of piece to be drilled was limited only by the unoccupied floor space in the shop.

A curious accident happened to one of the operators of this kind of a drill press. As no serious injury resulted, it was also very laughable. The man having a ragged sleeve to his jacket, was caught bv the set-screw of the spindle while in motion. As a result, he was jerked from his position as an "upright man" and his shoes made to describe a circle of about 12 feet in diameter. As the shipper by which the machine could be stopped was within this "charmed circle," it was necessary to stop the engine before the unlucky fellow could be released from his uncomfortable predicament.

The engines built in 1850 would seem like toys beside the monsters of to-day. According to the newspapers, a locomotive was put on a Western road, not long since, weighing 180 tons. The first-class passenger engine of the date above mentioned was about one-tenth that weight. A "Railroad Jubilee" was held in Boston in 1851 to celebrate the opening of railway communication with Montreal. In a trades procession which formed a part of the celebration, there were two locomotives drawn on large wagons by ten horses. Each one of these was followed by 300 mechanics, who bore at their head a banner with the legend, "Boston Locomotive Works Build 336 Locomotives." At that time they were putting out about one engine a week.

In 1852 the Globe Works, a locomotive shop in South Boston, reduced the working day from eleven to ten hours. This was done by Messrs. John Souther & Co. at the request of their "job hands." The employés of the Boston Locomotive Works were stimulated by this action to make an effort for a like reduction. A petition signed by a large majority of the workmen was presented to the company, asking for a ten-hour day. No notice was taken of this, and the petition was unanswered. The men then struck, all except the "job hands" going out.

A committee of the workmen presented themselves at the office and were met with soothing words from Mr. Hinkley. The "Deacon's" ire was aroused and he told the committee that if the matter were left to him, he would "let them all go to the d——l." But the company had large orders unfilled that could not be delayed. The demands of the men were allowed and the ten-hour day was established throughout Boston, for the small shops were obliged to follow the large ones. Not long after this event Mr. Drury sold his interest in the Boston Locomotive Works and became a partner in a large piano manufactory. In that disastrous year, 1857, when financial ruin swept like a cyclone over the whole country, the Boston Locomotive Works failed, and the shops were closed for several years.

When the concern resumed business it was under the style of the "Hinkley & Williams Locomotive Works." Mr. Williams was, I believe, from the Portland Locomotive Works, a shop that had formerly flourished. Mr. John Daniels was connected with the establishment in some capacity, and he continued with them and their successors till age incapacitated him from work.

Later the company was called the Hinkley Locomotive Works, and at last the Hinkley Locomotive Company. Mr. Frank Childs—a son of Daniel F., who was treasurer of the Baldwin Locomotive Works in 1851—was the manager of the latter company.

The location of the Hinkley establishment was in 1850 on Harrison avenue, Boston, and at that time there was a wharf at the rear end of the shop, where locomotives were loaded on schooners for transportation. The water could not have been much more than 200 feet from Harrison avenue. Later, the flats, which were nearly bare at low tide, were filled in, and Albany street opened, and the shops of the "Hinkley Locomotive Works" were fronted on the latter street. Fourteen acres were included in the plant, which is now occupied as a power house for the electric street railways of Boston.

SETH WILMARTH

was building locomotive engines in 1852—how long before that time the shop had been in existence, or how long after it continued, I cannot say; though I often saw the outside of the building on Foundry street, South Boston, near Cyrus Alger & Sons' South Boston Iron Works, I never saw the inside. A part of Mr. Wilmarth's business was construction of lathes and planers. It was said that he had the longest planer in the world in his shop, but whether it was 40 feet or only 20 I do not remember. Mr. Wilmarth was an eminent mechanic, and was for some years in the "sixties" master machinist at the Charlestown Navy Yard.

GLOBE WORKS.

The shops with the above name built locomotives previous to 1850. The loca-

SCENERY ON THE WHITE PASS & YUKON RAILROAD.

tion was corner of A and First streets, South Boston, and the firm was Lyman & Souther. In 1852 the style was John Souther & Co. Job and George Souther, brothers of John, were presumed to be members of the firm. The shops had originally been devoted to the construction of stationary engines and sugar mills for the Cuban sugar planters. The Southers had all been engineers on the island, and in the year mentioned Job Souther had just returned from a position there.

Engineers secured very high wages in Cuba, for machine shops were unknown there; all repairs must be made by them, and the engineer of that day and place must be equal to any emergency.

A ROTARY AT WORK ON TUNNEL MOUNTAIN, WHITE PASS & YUKON RAILROAD.

The Globe Works employed not more than 100 men; or at least, without anything but memory to depend on, I think that is about the fact. The shops were better equipped than Hinkley's, or at least there was more iron in the lathes and drill presses, and the planers were more modern. The system of "job hands," or contractors, was followed here. J. F. & C. E. Whittemore, James Briel, S. B. Bowles, S. P. Morse were among them. Patrick Lalley was boiler maker.

The draftsman was Zerah Colburn, who had written a book called "The Locomotive," and who afterwards edited a mechanical paper called *Engineering*, in London, England. He occasionally wrote for the Boston and other papers over the signature of "Zero." He contributed to a comic paper called the *Carpet Bag*, which was conducted by B. P. Shillaber ("Mrs. Partington"). Mr. Colburn was a phenomenal mental arithmetician, and was, I think, a grandson of the Zerah Colburn whose "Mental Arithmetic" was so well and favorably known as a school textbook fifty or sixty years ago.

Then engines built by Souther & Co. were favorably esteemed by the roads where they were used. They were, as also most engines of that day, "inside connected" engines; that is, the cylinders were directly under the boilers and close together, the axle of the forward driving wheels being a double crank, the throws of which were set quartering, as are the cranks of the present-day engines. This firm built quite a large number of engines for the Richmond & Danville Railroad, in Virginia. Mr. Souther became a partner in the Tredegar Locomotive Works, of Richmond, and induced a number of skilled workmen from the South Boston shops to go out and instruct the Virginians in the art of locomotive building. Very few, if any, of these remained in Richmond more than one or two years. The Richmond firm had the name of Anderson & Souther at first—afterwards as Anderson, Souther & Pickering. Mr. Pickering was an old Cuban engineer, and had been also an employé of Souther & Co. at South Boston.

The Tredegar Iron Works were in business during the civil war, and furnished the Confederate Government with most of the home-made munitions of war, but I do not think they built many locomotives after Mr. Souther retired from the firm in the late fifties. I am told that Mr. Souther is still living in or near Boston, being more than eighty years old. If he could be interviewed he probably could give more "points" about the "Old Locomotive Builders" than any other man now living.

A contributor to one of our contemporaries, in speaking of the coal question, says: "It is expensive to buy good coal; it is still more expensive to pay for good and get poor coal. A better way would be to buy poor coal and design fireboxes to burn it." That is very good logic, and would be very good practice, but unfortunately the conditions under which locomotives operate are not always favorable to this method. On many systems when coal is scarce, the cost of hauling coal from the mines to where the locomotives burn it is many times the cost of the coal when first loaded in the cars, in which cases it does not pay to handle a poor grade of coal, as there are too few heat units in comparison to the financial units involved. But just the same, a better design of firebox, that will burn poor coal successfully, will help out in the matter of saving good coal, by burning it in a firebox having more heating surface and more extended grate surface. The narrow, deep firebox is not a success in the large class of engines, and there is a question in the minds of many engineers as to whether the heating surface of a firebox that is 35 inches wide at the grate and over 6 feet to the crown sheet, with a very wide crown sheet, has as high evaporative power per square foot as the other type of firebox, with a wide grate surface and a narrower crown sheet, like the Prairie type, or the engine recently built for the Chicago & Northwestern Railway by the Schenectady Locomotive Works. The performance of this boiler will be closely watched, for it is a move in the right direction. A boiler with these advantages for freight service will be next in order.

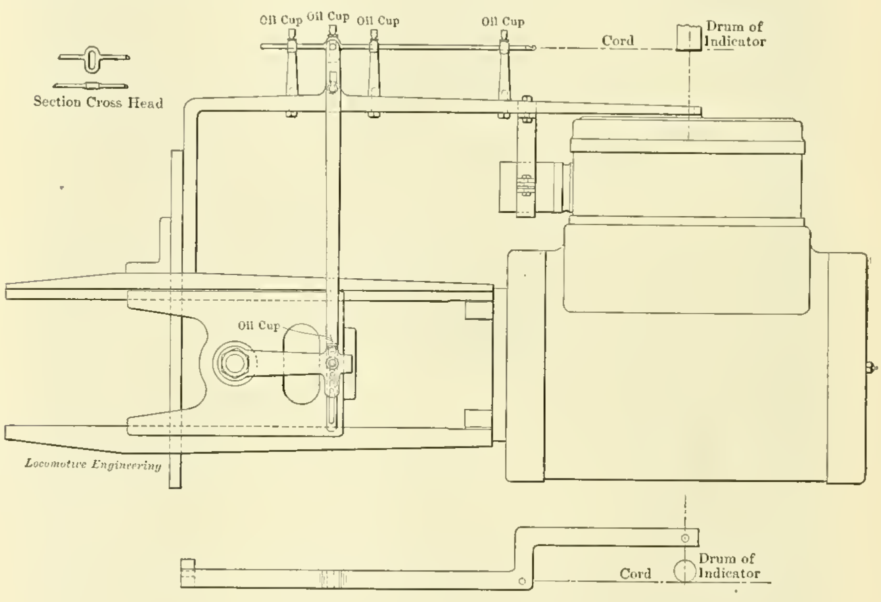
The small stations along the Boston & Albany road, built of granite or a stone closely resembling it and trimmed with a darker stone, are among the most attractive we know of. They are nearly all of a similar plain but neat design, and the dark tile roof makes a pleasing finish. The oiled roadbed, too, adds to both the comfort and scenery by making it possible to see perfectly all along the road even in the dryest weather.

Plant System Low Speed Reducing Motion.

The reducing motion or mechanism illustrated by the attached drawing is the one used on the Plant System for indicating freight or low-speed engines, or on both passenger and freight where the only object sought is the adjustment of the valve gear. It was designed by Mr. G. W. Wildin, mechanical engineer of that system. It will be seen that the location of the indicator drum is such as to require long pipes from steam cylinder to indicator, which for high-speed engines are objectionable. Where absolute accuracy is desired they substitute a modified form of this motion, which admits of the shortest pipes possible being used.

The object in designing the apparatus here illustrated was twofold: First, to reduce the travel of the indicator drum to admit of a 4½-inch card being taken with a 26-inch piston stroke, and at the same time get a positive and accurate movement of the drum; second, to reduce to a minimum the annoyances incident to long cords, spring appliances, running-board vibrations, etc., without drilling holes in any part of the engine to apply it.

Referring to the sketch, it will be seen that the framework of this device consists of a strong iron bar, bent in the desired form, one end being secured to steam-chest cover by the oil-pipe nut, while the other end rests upon the guide against the guide yoke, and is maintained in place by two of the guide-knee bolts. An auxiliary support is given this bar by a brace clamped around the steam chest stuffing box and bolted to the bar as shown. At a point directly over the center of the piston stroke a stud is inserted in this main bar, upon which is fulcrumed the main lever. The long end of the lever extending down makes connection with the crosshead through the medium of an iron plate, ½ inch thick. This plate takes the place of the wrist-pin washer and is secured in place by the wrist-pin nut, the forward end of the plate had a lug turned in, which rests upon the piston-rod boss of the crosshead proper. Sufficient space is maintained between this plate and the crosshead to allow the lever to work freely between them. The lower end of the main lever is slotted and works upon a roller secured by a bolt to the crosshead plate, while the upper end carries a roller which works in the Scotch crosshead of the communicating rod. At the left-hand upper corner of the sketch the construction of the Scotch crosshead is shown. Three columns are secured to the main frame as shown, which form the bearings for the communicating rod. Oil cups are placed at all bearing points to properly lubricate the moving parts. By moving the roller in the crosshead plate up or down, as may be desired, the indicator card can be lengthened or shortened to suit the taste of the operator. This construction permits of the use of a cord of only 12 inches in length. The communicating rod has a suitable hook on its end, and the cord can be attached or detached by the operator at will, regardless of the engine's speed. Mr. Wildin tried several devices, and found none which gave such general satisfaction and results as did the one illustrated. This device is not covered by letters patent, and can be used by those who wish to do so.



PLANT SYSTEM OF INDICATOR RIGGING.

The Link and Pin Coupler.

With the month of August the legal ban on the use of the link and pin coupler in the United States is made so decided that it is not likely we will see any more of them in service. Possibly our cousins in Canada may keep them in use on some of the local roads for a time; but the interchange system will have as much to do with effectually putting the link out of service as any statute law.

Michigan was the first State to take action on this matter of a legal type for the automatic coupler. After an extended trial, in actual service, of various couplers using a link, the Master Car Builders' type was formally approved in January, 1888, by Commissioner of Railroads John T. Rich, and a few months later the approval of the Commission was withdrawn from any coupler using a link.

This called down the wrath of the legion of inventors of the couplers using a link; but the Michigan law explicitly stated that an automatic coupler should "provide for the coupling and uncoupling of cars without the necessity of a man going between the ends of the cars"—something which is not possible with a link coupling when used in interchange service.

The question of coupling cars with the Master Car Builders' type of coupler on very sharp curves and uneven track around warehouses and unloading tracks is still an important one, but it will soon be solved when the use of the link is done away with. Of course it will take some special contrivance to attach to the knuckle; but the link slot and pin hole weaken the knuckle, so that some other device which will leave the knuckle solid will be on the market before long.

The Master Car Builders' type is nowhere near perfection yet. It is not uniform, so that the different forms of knuckles and heads will couple and stay coupled with each other, and in almost all of them two of the same pattern will not stay coupled after the parts wear so the knuckle gets lost motion.

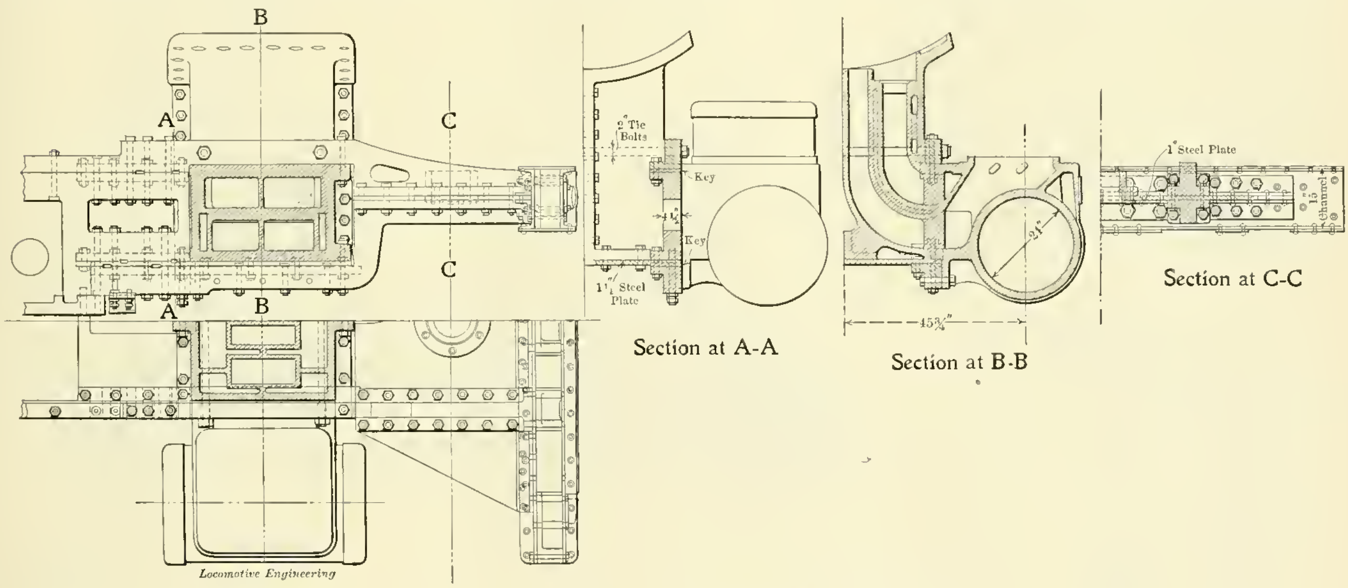
This is the next subject for inventors of new couplers to work at. From the past experience railroad companies have had with coupler inventors there is likely to be plenty of new designs.

Some years ago they were short of engineers on the Bee Line; so that when one was hired, he did not always have time to learn the road before taking a train out. One engineer was sent out on an official special without ever going over the road, and got along very well till he came to a gravel pit switch near Elyria, which had been left open; so he headed right in, and soon fetched up solid in the bank at the end. When the officials picked themselves up, after the sudden stop, they looked out and saw the engine half buried in the bank and the engineer coming away from her with his over-clothes already rolled up. They asked where he was going, and found out that Cleveland was his next stop. "Why don't you stay and get the engine out?" was asked. "Because I don't want to work for a company that won't tell you where the end of the road is," and on he went.

Cylinder Fastening of Large Bessemer Engine.

This shows the method of fastening cylinders on the large engine for the Pittsburgh, Bessemer & Lake Erie. It is a cast-steel frame—though not in one piece as shown by a contemporary—and seems to be thoroughly secured, both at the splice and to saddle.

There are two stiffening plates, one under the saddle of 1¼-inch steel plate, and one in front of cylinders, as shown, of 1-inch steel. The front one is extended beyond the frame at the angle shown in left-hand view. The row of bolts each side of both frames ought to provide ample fastenings. It will also be noticed that there are two tie bolts through saddle.



CYLINDER FASTENINGS OF THE BIG "BESSEMER" CONSOLIDATED.

Princeton Shops.

At one time the shops of the Louisville, Evansville & St. Louis Consolidated Railroad were located at Huntingburg, Ind., the junction of the Evansville branch with the St. Louis line. In 1896 they were moved to Princeton, nearer the middle of the road, another advantage being the receipt of sufficient local aid to put up the buildings.

Princeton is a very pretty little city of about 8,000 souls, with waterworks, and electric lights, and a steam or hot water central heating plant for residences and business houses is about to be installed. It has good schools and other social advantages. If railroad companies would look out for the educational and social advantages of their men first and land company interests last, the railroad shop towns would be more prosperous and homelike. Good men will stay at a place where their families are not contented only so long as they have to; poor men cannot get away. This lowers the general average grade of the employés so that the company suffers. Princeton men all seem to be contented and good-natured.

The shops are very substantially built of brick, with timber framing for roof structure and slate roofs. The machine shop is about 70 x 320 feet, with the boiler room at one end in another building. This central boiler house supplies steam for an independent engine in each of the shops. The exhaust steam is used to heat the shops. All the condensed water is trapped back to a central tank and returned to the boilers with a pump. In severely cold weather it is necessary to use some live steam. The wood mill and coach repair shop is next to the machine shop. There is provision for a transfer table to be set so as to serve the machine and coach shop. This transfer table will be put in in the near future.

Next to the wood mill and coach repair shop, which is 78 x 280 feet, comes the paint shop, 58 x 260 feet, which takes in four coaches at a time.

The heavy freight repairs of the road are done here, about seventy cars being under repairs at one time.

On the east side of the machine shop is located a large blacksmith shop, with twelve fires. They have some heavy machines, such as bulldozers, a double shear and punching machine and others. The storeroom is handy, while the oil house is at the other side of the yard, next the roundhouse. This takes up about two-thirds of a circle, has thirty stalls—fourteen for engines; the other sixteen are used for boiler and tank shop.

The best thing about the whole plant from a locomotive engineer's point of view is the cinder pit to clean out engines, and the accompanying depressed track to hold the cinders. The cinder track will hold two engines at once, or by close spotting three can have their fires cleaned. The ash pits are over three feet deep, with a slanting bottom, so the laborers can stand outside the tracks when loading cinders. The depressed track holds three cars and extends out far enough to hold four more, so it does not have to be pulled every time a cinder car is loaded, a fact the yardmaster will appreciate. This depressed track has concrete walls and bottom, with a drain to a neighboring creek.

The coal chute has ten pockets. The sand house is located in one end of the coal chute, so an engine can get the fire cleaned, take coal and sand and go into the roundhouse.

The plant is not as large as some others, but the arrangement and size are all right for the sixty engines that the road operates.

In the machine shop they have just put in an overhead traveling crane over one of the pits, which is operated by man power; it will handle anything up to two tons easily to either side or either end of the engine.

Malleable iron driving boxes are used on most of the engines with good results. The side next the wheel hub is spotted with babbitt. Without this the malleable boxes would cut the cast-iron hubs the same as steel.

Cast-iron eccentric cams 4¼ inches wide are used. This extra wide face prevents any heating.

Master Mechanic F. C. Cleaver was not at home when our scribe visited the shops, but the honors were done by General Foreman Moorhead, Machine Shop Foreman Dresher and Car Foreman Gaston.

The large roads with lots of money do not have all the handy shops and good machines for doing the repairs. Some of the smaller ones are well fixed.

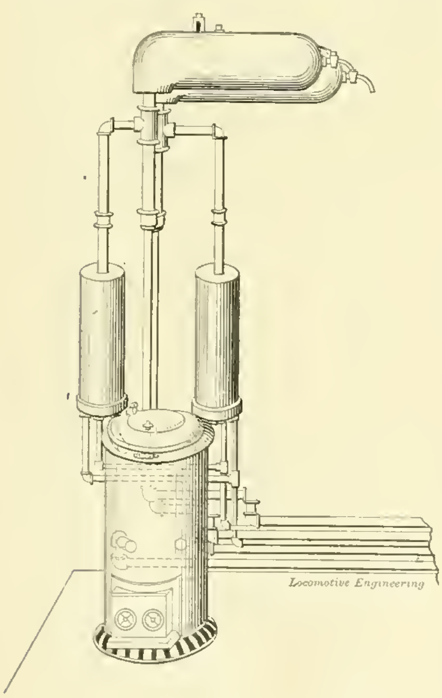
The new gage for Master Car Builders' couplers, as adopted at the last convention, is now being made by the Pratt & Whitney Company, Hartford, Conn. It is the same price as the old gage—$28, net. The contour gage for new couplers will be sold separately for $18.80, net.

New Consolidated Car-Heating Company Device.

In this issue is illustrated the new form of steam heater for use with a hot-water circulation in passenger cars, lately devised by the Consolidated Car-Heating Company. It consists of a double coil Baker heater connected to the pipes in the car in the usual manner. In the pipe from the coil to the reservoir is placed a steam heater, 6 inches in diameter by 23 inches long, through which the water passes; a copper coil giving a large amount of surface is located in this heater; steam from the train pipe passes through the coil.

The heater tends to circulate the water through the coils of pipe in the same direction as the fire, so that both steam heat and fire can be used at once or separately. In case it is necessary to change from steam to fire heat, or *vice versa,* it is not necessary to stop the operation of one till the other is doing the full service.

In the older form of steam heater—the commingler system—the steam used for heating the water was condensed and became part of the water in circulation. There was also a possibility of losing some of this water into the steam pipe when the steam was shut off at the engine. With this new device the circulation is closed, so no water can escape when the steam is



CIRCULATING COILS OVER HEATER.

shut off. Salt water can be used in the heater if desired.

Another feature that is commendable is, bringing the live steam around the trap on its way from the train pipe to the heater, which ensures that the trap will be warm while the heater is working, so the drip will not freeze up. The illustrations explain all these good points.

A Train Racing Pigeon.

There is a pigeon in Belgium which regularly flies with the morning train that goes from Liege to Waremme. It began to accompany the train towards the end of January, and it has done so every day since then, except on three occasions. The *Meuse,* one of the leading newspapers in Belgium, vouches for this fact, and gives other curious details about the remarkable bird. The train starts at 3 minutes to 10 A. M., and a crowd gathers daily to see the pigeon go with it. The bird wheels ar und the station while the passengers are taking seats, and as soon as the whistle is blown and the journey begins it takes up a position a little behind the engine, and there it flies, surrounded by the moist, though warm, steam, which it evidently enjoys. It retains this position even while the train is passing through tunnels, and apparently is not incommoded in the least by the warm vapor. When the train reaches its destination the bird flies swiftly along the railroad track back to Liege, where it arrives about half-past 11 o'clock.

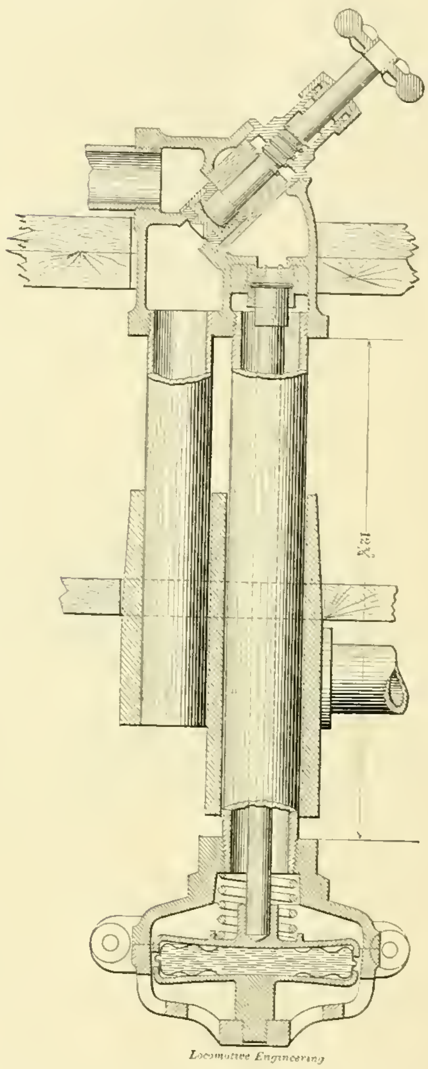
This pigeon was born at the railroad station in Liege, and consequently is familiar with trains, smoke and steam. Until a few months ago it occupied, with eleven others, a comfortable cote, and when this was removed from the station by order of the authorities it refused to abandon its old home, though its eleven companions at once sought for shelter elsewhere. This fidelity was suitably rewarded. The railroad officials gave the bird *carte blanche* to search for food wherever it pleased, and the public liberally supplied it with corn and other dainties. A singular fact is that on the three days when it failed to accompany the train a Belgian engine was used, instead of an English one, and the assumption is that the fuel consumed by the latter gives forth a steam which the bird prefers to that from a Belgian engine.—*Railway Herald.*

Wheat Blockades Texas Traffic.

A serious blockade of traffic on the railroads of Texas is caused by the inability of ocean steamships to carry away the enormous quantity of wheat which the railroads have hauled into Galveston. The steamship men have been caught unprepared on account of the grain movement beginning three or four weeks earlier this year than usual, and are doing all they can to relieve the situation by chartering all the steamships they can find.

The Texas Car Service Association reports that between 1,200 and 1,500 grain cars are constantly waiting to be unloaded. The grain elevators are full, and the process of unloading is so slow that the number of cars is steadily increasing. Much Galveston wheat is being diverted to New Orleans, while much of the Kansas wheat which usually seeks a Southern port is being sent to Chicago to be sold. The blockade has seriously inconvenienced all the Texas roads, and a car famine seems imminent.

Rail joints on the New Haven road attract attention for two reasons: They use four-bolt fish plates on 100-pound rails and alternate the bolt heads from inside to outside. This brings two heads and two nuts on each side of the joint, which looks odd at first sight. The joints seem to hold well, however, for the track is particularly easy riding.



SECTION OF TRAP.

Ten Greatest American Railroads.

A table showing the mileage controlled by the principal railroad companies of this country on July, 1900, has been compiled by the *Railway Age.* The ten largest systems are as follows:

New York Central	10,410
Pennsylvania	10,392
Canadian Pacific	10,018
Southern Pacific	9,362
Chicago & Northwestern	8,463
Chicago, Burlington & Quincy	8,001
Southern Railway	7,887
Atchison, Topeka & Santa Fé	7,880
Chicago, Milwaukee & St. Paul	6,437
Union Pacific	5,584

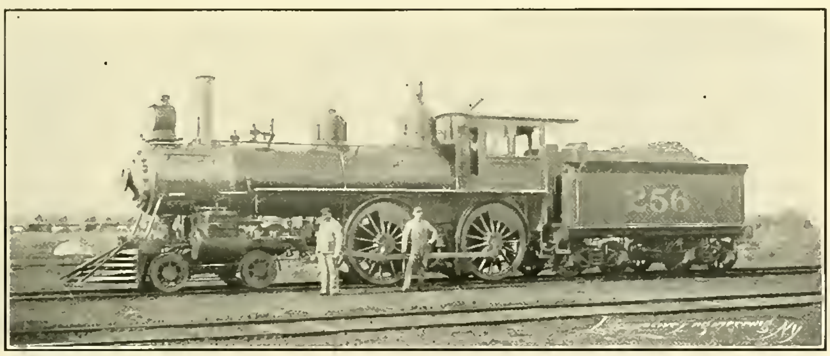
The Pennsylvania Railroad is the largest system in the country under one name. It is shown that twenty-eight railroad companies control a total mileage of 147,061.

General Correspondence.

All letters in this department must have name of author attached.

A Santa Fe Flyer.

I send you photograph of engine No. 256. On March 29, 1900, this engine pulled the Peacock special from La Junta, Colo., to Dodge City, Kan., a distance of 202 miles over the Atchison, Topeka & Santa Fé Railway, in just 202 minutes, including one stop for water at Syracuse, Kan. The engine is a McQueen, manufactured at Schenectady, N. Y.; 18 x 24 cylinders; inside diameter of boiler shell, 54 inches; working pressure, 150 pounds; total weight, 60 tons; wheel centers, 62 inches; 9 feet between wheel centers; built in 1887, with Jere Shaw as engineer. The Peacock special, so called, was a train that brought Mr. Peacock from California to Pittsburgh, Pa., to attend a meeting of the stockholders of the Carnegie Steel Works.



SANTA FE FLYER—ENGINE OF PEACOCK TRAIN.

I send you the photograph and this account for such use as you may wish to make of it. STUART C. SUTTON.

Dodge City, Kan.

Wants to be Relieved of Cleaning.

Why is it that the fireman is still required, in this advanced age of railroading, to clean and scour his engine the same as in the old days, when the coal-heaving part of the job was a snap, and firemen were selected because of their ability to keep a brightly scoured engine rather than for their skill to "keep her hot?"

In those days the prettiest engine was the one with the most brass and gold leaf on her. And there never was an opportunity lost to put a little more on. The best fireman was the best cleaner. He used to heave a few tons of coal in a few hours' trip, and then his real work began. He mixed up his sperm and pumice-stone (nothing harsher was allowed in those days) and scoured and sweat for several hours, only daring to quit after each bit of brass shone like a mirror, the jacket likewise, and the paintwork glistened.

Little, skinny fellows in those days were just as good firemen (or cleaners rather) as the big, stronger men. Nowadays the fireman that can toss the most coal is wanted. The engines have grown much bigger, the work is harder, but the increase in pay has not been the same as the increase in work. It looks to the writer that the fireman could justly be relieved of the cleaning nowadays, and be allowed to get off his engine at the end of the trip, the same as the engineer.

Chicago, Ill. R. L. MAHONEY.

Grab Irons and Door Seals.

Why has the half-circle offset in the grab iron or hand hold on box-car roofs been abandoned? It was a mighty handy place to set a red light in and be sure it would stay, and it answered for both a "tail light" and a "worker" for yard service. It was also a good place for the brakeman's lamp when he was exercising the brake handle.

Do car builders realize the pleasure it gives a conductor to stand in a ditch, a foot below the rails, and stretch like a giraffe to locate the seal half-way up a car door? On a bad night, with water running off the roof and down your sleeve and the yard master trying to hurry you, the man who can keep from swearing must have wings sprouted under his coat. But as the record of seal must be had, why not put seal hasp at bottom of door, as some roads are doing?

TOM C. JOHNSON.

Allegheny, Pa.

Getting off the Center.

In the June number of LOCOMOTIVE ENGINEERING A. J. O'Hara has an article on "Getting Off the Center," which is very good, but I think I have a better way, and one that does not necessitate cutting out the tank brake or angle-cock behind tank. With a push-out driver brake and conditions as he cites, with the adjustment let out on the driver brake, get your sticks against the piston; the brakeman on the one side and fireman on the side that triple valve is on. Have your engineer's valve in full release. Fireman holds stick and at the same time turns handle of driver triple valve into straight air (driver brake, triple valve handles should all be fixed so they can be cut into straight air to test them), which pushes out driver brake pistons; and as handle of engineer's valve is in full release, it will rarely, if ever, set the brake, and if it does, will release it instantly and offers no resistance to starting. This could be repeated in an incredibly short space of time. There would be cases where it would not be necessary to have a stud in driver if the brake cylinder set a distance out; you could catch it in a spoke or on the counterbalance. A. A. LINDLEY.

Oskaloosa, Ia.

I find, in the August number of your valuable journal, a criticism on my method of getting an engine off the center by using driver brake piston when it is located on the rear of the engine frame.

This is not a device for getting engines off the center. It is put there to apply the brakes to the driving wheels, and without any change or expense I discovered a way that the power could be transmitted to the driving wheels by the manipulation of three valves—the engineer's valve to increase the power in the train line, the cutting out of the tender brake triple valve so its brake would not apply, an angle cock on the head end of the car for the same reason, to be immediately opened as soon as the train was started. And now I will go further, in case train would not start with 90 pounds train line pressure, a blind gasket could be put into the pump governor pipe at the union next to the engineer's valve, so as to let pressure come up to boiler pressure, a cent or a dime making a very good gasket, if the engineer was fortunate enough to have either, and if this pressure would not start the train, you could get a greater pressure by wrapping brake cylinder pipe where it enters the brake cylinder with waste saturated with kerosene oil, thereby getting the expansion of the air in the cylinder which would amount to a greater pressure exerted on a possible 2 to 6 inches greater leverage than the cranks have. Of course, the higher up or nearer to the rim or periphery of the wheel to get your push stick, the greater will be your leverage. I therefore do not consider this a device, but a discovery pure and simple. It does not cost any additional expense, but the apparatus is there for one purpose and we find it useful for another and utilize it.

Then he tells about tangling up the valve with a bell cord and about tying it to the guide yoke. No need to go to all this trouble. Double your bell cord, put a slip noose around your valve stem, throw it right over your steam chest and make it fast to anything directly ahead—the front cylinder cock if you choose; put a binder crosswise in the bell cord, a packing iron or hook, or a stick 18 inches long, twist it up and tie it on anything convenient to hold it, and the valve will not move. Just pull your valve back far enough so the cavity of the valve will open your back port to the exhaust port, and when your piston comes on its backward stroke it will drive the air out through the exhaust to the stack; then slack up front cylinder head, drive small wedges of wood between the head and cylinder, and you are ready to go. Never mind your canvas curtain. You will not have any use for it; nor will you have to take out the indicator plug.

In regard to putting a whistle in the air reservoir to notify the engineer that he is losing his air, there cannot be too much precaution. I would suggest that the warning port be changed from the position of full release to the running position, so if the handle is accidentally moved from running position to lap it will give a warning. It will also give the same warning it does now at the full release position. It will answer both purposes. We have had two cases of handle to engineer's valve being pulled over to lap by bell cord catching on handle unknown to the engineer. This happened on express trains, and in both cases train line pressure leaked gradually away and did not set the brakes. If the warning port had been in running position this would not occur, and both of these cases I cite were two of our best engineers. ARTHUR J. O'HARA.

Port Jervis, N. Y.

Easy Packing Driving Cellar.

The sketch attached is the outgrowth of a study of some means of packing a driving cellar quickly without dropping it, and at the same time get a device which would not allow the oil accumulating to escape from the cellar.

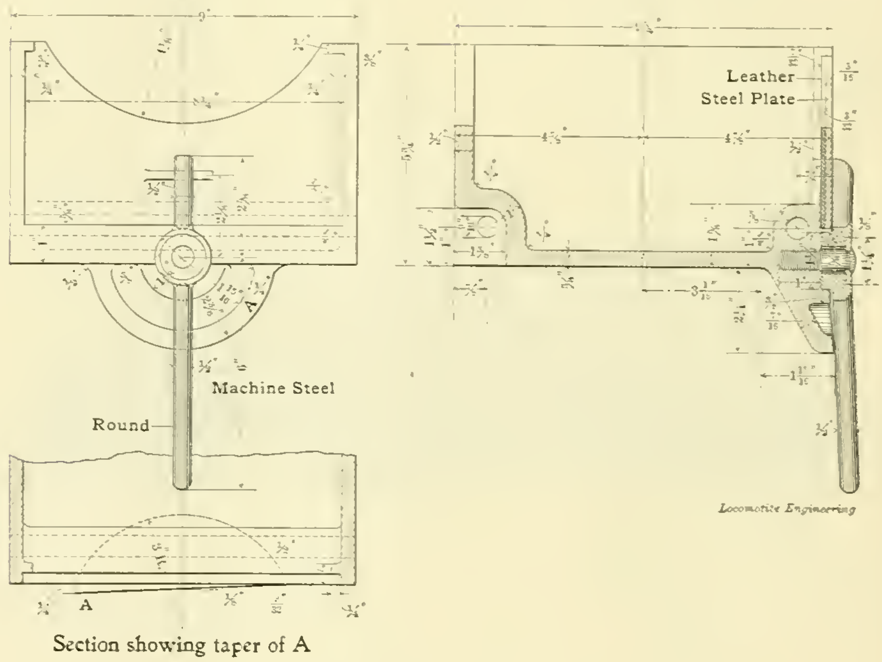
A cellar constructed as shown in the sketch can be packed quickly and effectually without the use of either a hammer, wrench, screwdriver or cold chisel.

The construction and operation are as follows: The inner end or face of the cellar is entirely removed down to within 1¼ inches of the bottom. At the sides and bottom of the removed end is a recess, 9-32 inch deep, ¼ inch wide at sides and ⅝ inch wide at bottom. This recessed portion receives a steel plate 3-16 inch thick, lined on its inner side with a 3-32-inch piece of leather. The steel plate, leather lined, takes the place of the cast end of the cellar removed, the leather lining assisting in forming an air-tight joint. On the under side of the cellar is cast a semicircular wedge-shaped lug *A*, which is just flush with the face of the cellar where it meets it on the right side and projects ¼ inch past the face of the cellar where it meets it on the left. The steel door-plate has on its face a small wedge-shaped projection which may be formed by stamping with a die. The lever which transmits the necessary pressure to make a tight joint between the door and cellar is fulcrumed on a stud screwed into the body of the cellar and is riveted over on its outer end to keep the lever in place. This lever, it will be seen, has two bearing points, one on the small wedge on the steel door and the other on the semicircular cast wedge *A*. It is evident, then, that the harder you pull the lower end of the lever to the left, the more pressure you apply on the bearing on the door. As no portion of this mechanism is required to be finished, its construction is very cheap.

To operate the device in order to pack a cellar, push the lower end of the lever to the right, thus sliding the upper end off the small wedge on the door at the same time the lower end is approaching that portion of the cast wedge *A* which is just flush with the face of the cellar, thus clearing and removing the pressure on the door altogether, allowing it to be removed by the hand. After the cellar has been packed, the door is again put in its place and the lever pulled to the left until a tight joint is secured. To prevent the lever from slipping from any cause, as from the jar of the engine, etc., a large notch is filed in the cast wedge *A*, into which the lower end of the lever is placed.

Engines equipped with this device have been in operation about one year, at this writing, and not the slightest trouble has been experienced in any way. If it is found desirable to use a shorter lever than the one shown, it can be done. In such cases the hammer will have to be used to move the lever, instead of the hand.

G. W. WILDIN,
M. E., Plant System.



IMPROVED DRIVING-BOX CELLAR.

Firing Big Engines.

On page 344 of your August issue is an article on mechanical firing, which is very good, but does not go far enough to solve the difficulties met with in firing the large engines by hand.

Some of the excessively large engines now in service develop nearly twice the tractive force that the engines did which were handling the trains five years ago. To develop this power takes about twice as much coal, and unless the engine is a good steamer, it is not unusual to find the large engines burning more coal in proportion to the work done than their smaller predecessors did. Of course, the large engine and tender is many times heavier than the small one. This extra weight has to be moved the same as the loaded cars; it takes coal to move tonnage. One difficulty with some of the large engines, which we did not have with the smaller ones with deep boxes, is the high firebox door, which calls for lifting the coal that extra height. This is very noticeable on some engines. The big Brooks engines have the deck of both engine and tender raised up near the door, but there are others that do not. If it takes a special design for the tender, to get the coal deck from which we shovel the coal up near the level of the firebox door, I say have that special plan made, and thus have the coal where it will not need to be lifted any.

To get steam for a heavy train coal must be skilfully placed on the grates where and when it is needed. A fireman should have all the help possible in the muscular part of his work if his mental powers of skill are to be of service.

Then there is a lot of work around the large engines which the man who fires them out on the road should be relieved of. We refer to the cleaning of the engine, both outside and inside of the cab; the filling and care of signal lamps, drawing of stores, etc. With the small engines all this work could be done in a few hours; the large ones take from half to three-quarters of a day, and thus rob a fireman of his rest.

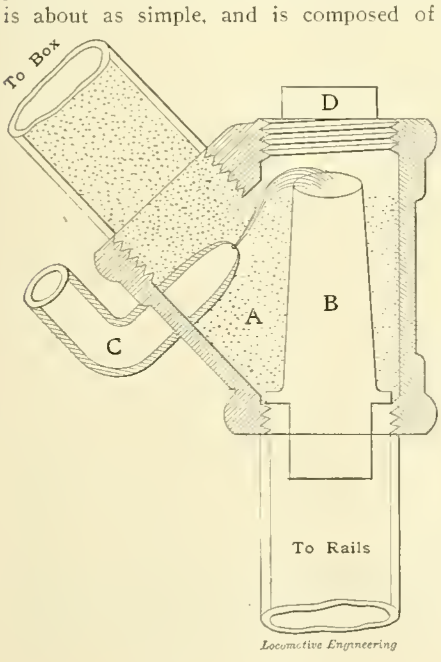
Possibly this last mentioned matter is more in the nature of a kick than a condition peculiar to the large engines; but it does seem that when the work while on the trip is so close to the limit of a man's ability, the other should be done by some-one else, and have the fireman ready for a trip with full strength.

Mechanical stokers may relieve the fireman of the muscular exertion of handling the fuel, but they cannot relieve him of the other work which he is expected to look after on the trip. S. Z. KILMER.

Indianapolis, Ind.

Another Air Sander.

I enclose a pencil sketch of a new pneumatic track sander which I have just patented and which I call A B C D, as it is about as simple, and is composed of



A B C D SANDER.

only four parts, namely: *A*, an ordinary Y casting; *B*, a loose tube; *C*, an air inlet; *D*, a cleaning plug, which, when removed and tube taken out, allows all sediment to pass through pipes to rails, and not on engine's machinery. To use in case of failure of air, leave tube *B* out, and you have same old hand device; same pipes are used. Requires less air to work than any sander on the market, and does not blow sand off rails; will work any kind of sand, and gravel will not stop it.

J. H. WATTERS,
Div. M M., L. & N. R. R.

About the "Advance."

In answer to friends from Taunton, Mass., in regard to Corliss engine, page 371, August issue, would say that I fired the engine named "Advance," that he speaks about on the Cincinnati, Hamilton & Dayton Railway in the year 1864. This engine had four valves and four short rocker arms on each side, with one eccentric to a side and an arm on each main pin, that acted as an eccentric, with a reverse lever for forward and back motion, with another lever bolted to the inside of cab, used as a cut-off. The dome was near the stack. There were two safety valves, about 4 feet apart, with a spring extended from one to the other, bolted through the middle or band to top of boiler. This engine and another, I believe, by the name of "West Boston," were purchased by Mr. L'Homedieu, president of the road at that time. W. J. GUY.

Hamilton, Ohio.

Oil Cellar Remover.

In your July issue I see cut of device for removing oil cellars, so I send a sketch of one we have used on the Fonda, Johnstown & Gloversville Railroad for over six years, which is very simple and effective, as it removes all size cellars without any adjustment. I have used it on locomotives ranging from 20 to 70 tons.

Gloversville, N. Y. SAM'L. TORRENS.

Some Interesting Nozzle Experiments.

BY FRANK E. DILLON.

About six months ago there were two of our engines on the Chicago & Eastern Illinois road equipped with Sweney exhaust nozzles. One of the engines was a Pittsburgh mastodon, 21 x 26-inch cylinders; the other an eight-wheel Schenectady passenger engine, with dimensions as follows:

Cylinders—18 x 24 inches.

Driving wheels—66 inches.

Straight boiler—60 inches diameter.

Firebox—Length, 108 inches; width, 32½ inches.

Tubes—Number, 217; diameter, 2 inches; length over tube sheets, 11 feet.

Total heating surface, 1,397.4 square inches.

After a great deal of argument over the qualities of the new nozzle and its superiority over the prevailing style of plain exhaust pipe, it was decided to make an exhaustive competitive test, and the passenger engine was selected for the trial.

The form of the Sweney exhaust is that of a very large nozzle with a series of

OIL CELLAR REMOVER.

bridges inserted in the opening, and the outcome of the test so completely explodes the theory that "a bridge in a nozzle tends to create back pressure" (see work on Northwestern Railway testing plant), that it needs no comment.

It was agreed that each front end was to make five round trips on the evaporative test, and then was to make one trip with the indicator. The Sweney was already in the engine, and was set to use run-of-mine coal. She had been steaming remarkably well, and was put into the test without any change whatever being made in the front end.

At the instance of the locomotive department, screened lump coal was specified for the test. Engineer C. L. Cole and Fireman Landis were placed in charge of the engine. Mr. Harry Crull, assisted by Mr. Elmer Owens, represented the road. Mr. G. R. Smith looked after the interests of the Sweney nozzle. The principle of the Sweney exhaust lies in its ability to combine the products of combustion thoroughly with the exhaust steam at the very top of the tip, where the velocity of the steam is at its highest, and thus completely fill the stack from the bottom up with thoroughly mixed steam and gases.

On the trips south the engine handled seven cars for the first 124 miles run, and four cars for the remaining 54 miles of the trip. This train's number is 7, and in the following reference will be made to these runs as No. 7, and the return trips as No. 4. No. 7's time for the 177.8 miles is 4 hours and 39 minutes, with 6 minutes dead time at Danville Junction and eleven other stops for passengers.

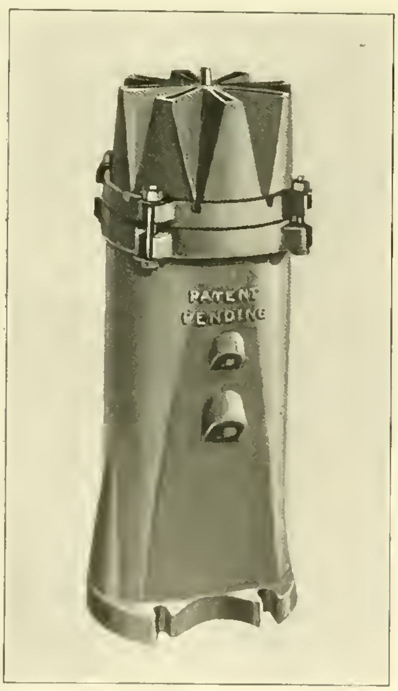
The tons pulled on No. 7 were identical

on each of the ten trips, and the atmospheric conditions as near uniform throughout as it would be possible to obtain. Delays were about the same.

On No. 4 there was a difference in the weight of trains, and the time made, so that the conditions of service were more varied.

The whole of No. 7's runs show a saving of 13.3 per cent. in favor of the Sweney.

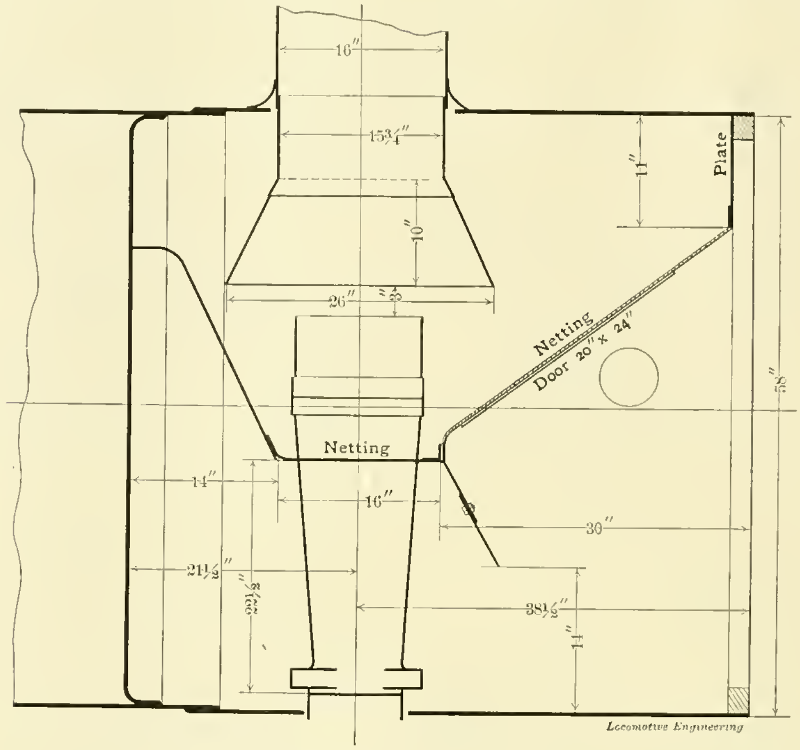
Taking into consideration the added comfort and advantages of an extraordinary good steaming engine, it would be a difficult thing to express in figures the percentage of gain in satisfaction to the engine crew. The cards show the effect both of the plain exhaust and of the Sweney. The plain tip used was 4¼ inches in diameter; area opening, 14.18+ square inches. The area opening of the Sweney used was 16.80 square inches, or the equivalent of a plain tip of 4⅝ inches in diameter and ⅜ inch larger than the plain tip used. The engine's performance was so satisfactory with this tip that it was decided to try a still larger one. And after the official test was completed, one equivalent to 4¾ inches was put in. With this tip the engine averaged 174 pounds for the trip on No. 7; but they were surprised to find that the indicator showed no decrease in back pressure from that of the 4⅝-inch tip, which showed conclusively that, with a nozzle larger than 4⅝ inches, the back pressure was dependent upon the size of



SWENEY EXHAUST.

the steam ports rather than the nozzle tip. With this large nozzle the vacuum, however, was greater than that obtained from the 4¼-inch plain tip.

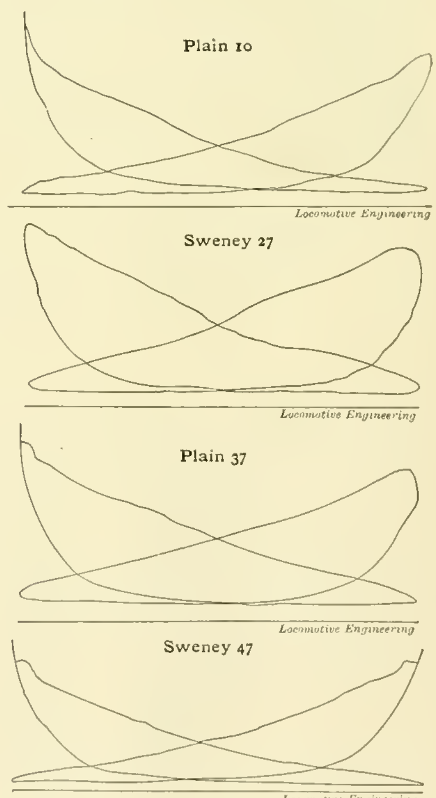
The Sweney nozzle in all of the trials showed greater vacuum, burned less coal, used a smaller quantity of water and indicated lower back pressure than the plain tip; while the average steam pressure maintained with the Sweney was 176 pounds against 162 pounds with the plain tip. This nozzle does away to a great ex-



FRONT-END ARRANGEMENT OF SWENEY NOZZLE.

tent with the nuisance of sharp exhaust; and I have stood two blocks away from the starting point, and as this engine passed me I could hear the turbine engine of the electric headlight working above the sound of the exhaust.

On the cards compared the back pressure was 15 per cent. less with the Sweney than with the 4¼-inch plain tip; and the vacuum with the Sweney was 11 per cent. greater, the average vacuum efficiency of the Sweney over the plain exhaust being about 25 per cent.



CARDS.

New Cars Intercepted and Used in Famine Time.

The car famine which occurs each fall during the movement of grain eastward and the present blockade of cars in Texas, due to the inability of Galveston steamships to receive cargo as rapidly as offered, brings to mind an episode which transpired last fall when freight cars were in great demand and the railroads were devising all manner of means whereby they could have and hold as many as possible of their own cars as well as those of their neighbors.

A certain Western road, badly in need of more cars and suffering from the car famine, placed a rush order for 500 cars with an Eastern car works. The cars were hurried out by the builders and shipped to the Western road, but somehow they failed to reach their destination. Upon investigation, the badly-pressed road found that the whole 500 cars had been confiscated and were being used by a road over whose line they had to pass. The owner was furious, refused to be comforted by payment of rent, and entered suit. The confiscator apologized profusely for the act, said that he couldn't bear to see an empty car pass over his road when he needed cars so badly, and finally settled with the owner, still holding on his side a neat net profit.

A New Tool Steel.

Even in this day of wonderful mechanical accomplishments we are very apt to look askance at the man who offers to double the output of a shop, if we will only use his steel. It sounds like a bold attempt to unload a lot of steel on us—good enough in its way, perhaps; but the idea of doubling our output seems absurd.

But the Bethlehem Steel Company are prepared to not only double but treble the output of a shop, so far as planing, turning, slotting or boring are concerned, and gave a very interesting exhibition of the steel on the last day of July, to convince any doubters as to its value.

About two years ago they were confronted with the unpleasant fact that the machine shop—in spite of its being the largest in the world—was unable to keep up with the forge, and forgings accumulated very rapidly. To build and equip another shop over 1,300 feet long, meant at least a million dollars, and it was determined to see if the shop output could be increased. With this in view, Mr. F. W. Taylor was engaged to see what could be done. He found a large variety of steels in use, and selecting a few of the best, discarded the others, so as to have uniform production from tools. A special lathe was set aside for experimental work, and together with Mr. Maunsel White the work was begun.

The thoroughness of these is shown by the fact that considerably over 10,000 tests have been made, costing over $100,000 in labor and material alone, over 200 tons of steel having been cut up in these experiments.

These led to the discovery, on the part of Messrs. Taylor and White, of a process of treating steel by which its ability to stand heat and still cut has been largely increased. Mushet tools break down at about 650 degrees of heat, while the Taylor-White steel will stand up under from 1,100 to 1,300 degrees, and still cut.

The process, then, may be said to raise the critical point at which the tool burns off the edge. How this is done is one of the secrets known only to those who acquire the right to use it. The practical results of the introduction of these tools have been the speeding up of the line shafting from 90 to 250 revolutions per minute, and the increase of work as shown below:

Average.	Oct. 25, '98.	May 11, '99	Jan. 15, '00.	Gain in % Cut of 3d Over 2d.	Gain in % Cut of 3d Over 1st.
Cutting speed	8′ 11″	21′ 9″	25′ 3″	16%	183%
Depth of cut	.23″	.278″	.30″	8%	30%
Feed	.07″	.0657″	.087″	32%	24%
Pounds of metal removed per hour	31.18	81.52	137.3	68%	340%

The practical speeds for these tools are from two to four times that of any other steels they have tried, and these figures were borne out in the experiments shown, which were as follows. Cuts were 3-16 inch deep, 1-16 inch feed in all cases.

First Test—Very hard tool steel, 1.05 carbon, was turned at 15 feet per minute. Tool was run about 20 minutes and was not used up when removed. Mushet tool which replaced it only lasted about 23 seconds.

Second Test—Cast iron; 50 feet per minute. Tool run about 16 minutes and was O. K. Mushet lasted 20 seconds; then other was replaced and turned out the hard ring left by burning mushet tool.

Third Test—Soft steel, .10 to .20 carbon, turned 120 feet per minute. Tool was all right after running 15 minutes, during which time it was seen to be red hot at point. Mushet tool lasted 7 seconds and was burned off badly.

These tools are used largely for roughing work, and leave a good surface, even at very high speeds, where the cuts are not too heavy; but cuts an inch in depth are not expected to be very smooth, and that is what is done in some cases. The last cut, of 3-16 deep and 1-16 feed, gives quite a smooth surface.

All the standard self-hardening steels are improved by this process, but the special steel used gives the best results. This is easily forged to any desired shape and then treated by the Taylor-White process, which penetrates to the center of the largest tools yet tried—4 inches square. It can also be readily annealed, making it available for milling cutters, drills and similar tools.

When cutting dry, the chips turn blue when the tool is cutting at its maximum rate, and a foreman can readily see what is being done by turning off the water for a moment and watching the chips. The use of water increases the possible speed about 40 per cent.; so that while the maximum dry speed is 150, it is possible to run over 200 revolutions on soft material when water is used.

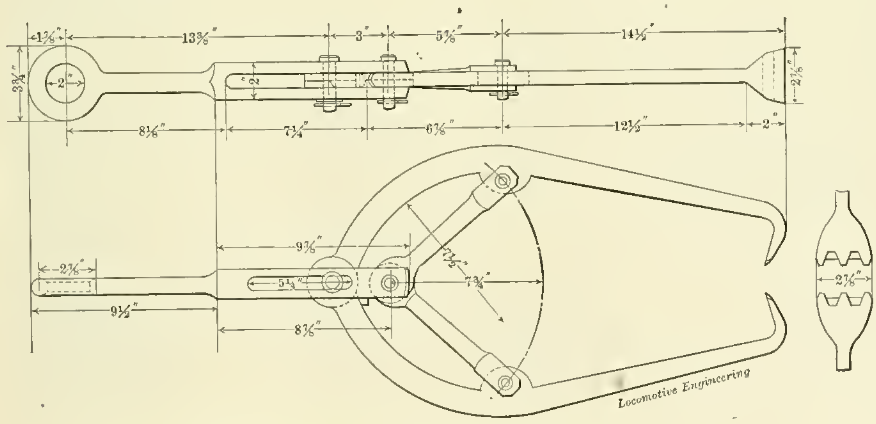
The patents for this are now owned by the Bethlehem Steel Company, who are selling shop rights on the basis of the number and size of machines on which the tools treated may be used to advantage. A more equitable basis could hardly be devised, and the fact that one shop is using it with only three machines, shows that its usefulness is not confined to large shops.

We understand that numerous inquiries are being received from abroad, England being in the lead, and that over one hundred shops here have sent representatives to investigate it, and among them are railroad shops, we are glad to say, as well as others.

After the experiments a very substantial and enjoyable lunch was served, at which souvenirs in the shape of steel tapes were distributed.

When we consider what an enormous increase in the output of a shop this makes possible, it recalls the anecdote of a German visitor, related by Mr. H. F. J. Porter. The Teuton had been astonished at the results obtained from the steel in question, and was asked what he would say to his friends at home when he returned. He replied: "I vill say nuttings. Eef I tell dem vat I see, dey say I vas dhrunk."

The experiments were witnessed by the writer before lunch. C.



CLAMP FOR HANDLING LUMBER—SOUTHERN RAILWAY.

The meeting of the Traveling Engineers' Association will be held in Cleveland, Ohio, this year, beginning Tuesday, September 11th. The Colonial Hotel, which will be the headquarters, is one of the finest hotels in the city and will have very good accommodations for the members and visitors. The meeting will be held in one of the halls in the hotel, that is well lighted and well ventilated. The subjects to be discussed are of special interest. Cleveland is one of the beautiful cities of the United States. There are many attractions for visitors, so that all will have a pleasant time.

Dampers.

"No use talking to us about dampers to-day: they do not amount to much or the company would keep them in better order; most of them will not open wide, none of them will shut tight, some are gone altogether. They are in your way when hoeing out the pan, and might as well be taken off and have done with the trouble they make," you say.

Not quite so fast, my boy. Dampers have a mission, just the same as the ashpan. We will admit all that you charge about their general condition, and add another count, which is, that a good many of the front dampers, where they can be opened wide while the engine is running, are apt to get up high enough to catch the bottom bolt in the eccentric strap and break a strap.

A good many engine failures of this kind—broken straps—could be charged against the damper flying up too high; better examine the damper for the marks when you take the broken strap off.

But dampers have their uses, just the same. The amount of air passing into the ashpan and then up into the fire needs regulating by other means than the thickness of the fire or the sharpness of the exhaust; it can be best done where it first comes into the pan.

Many of you can call to mind engines that will steam well with the back damper open, others with the front one. Others, with the same grate surface, need both dampers; some engines will not steam at all with both open.

The size of the dampers does not receive much attention from some engine builders. One of the largest engines in the United States has dampers no larger than the 16 x 24 engine by the same builders.

With the perforated ashpans used on some roads it would seem that no dampers would be needed except to open the ends of the ashpan to get the ashes out and close the pan to prevent the live fire from coming out. It seems curious that the companies who use perforated pans with enough openings in the sides to equal the air opening up through the grates should expect the dampers would be opened to admit air, but they have handles coming into the cab and rules for their use. They also have a rule forbidding the popping of the safety valves when the throttle is shut, and at the same time fix it so you cannot shut off the supply of oxygen to the burning coal; it is likely intended that the fire will be thin enough, or burned out, so that it cannot make the boiler pop, or so heavy a fire that the air cannot get through the fire without some coaxing with a sharp exhaust. A heavy charge of fresh coal on a lively fire will generally hold back the popping for a few minutes, but when the pop does go off it is good and plenty; so you cannot try that, unless about ready to pull out. If the supply of air to the fire could be regulated it would help this. The dampers should do it.

But, leaving all sarcastic remarks to one side, dampers are of value, and should have attention. One reason why they receive so little attention when out of order is because their true value is not known.

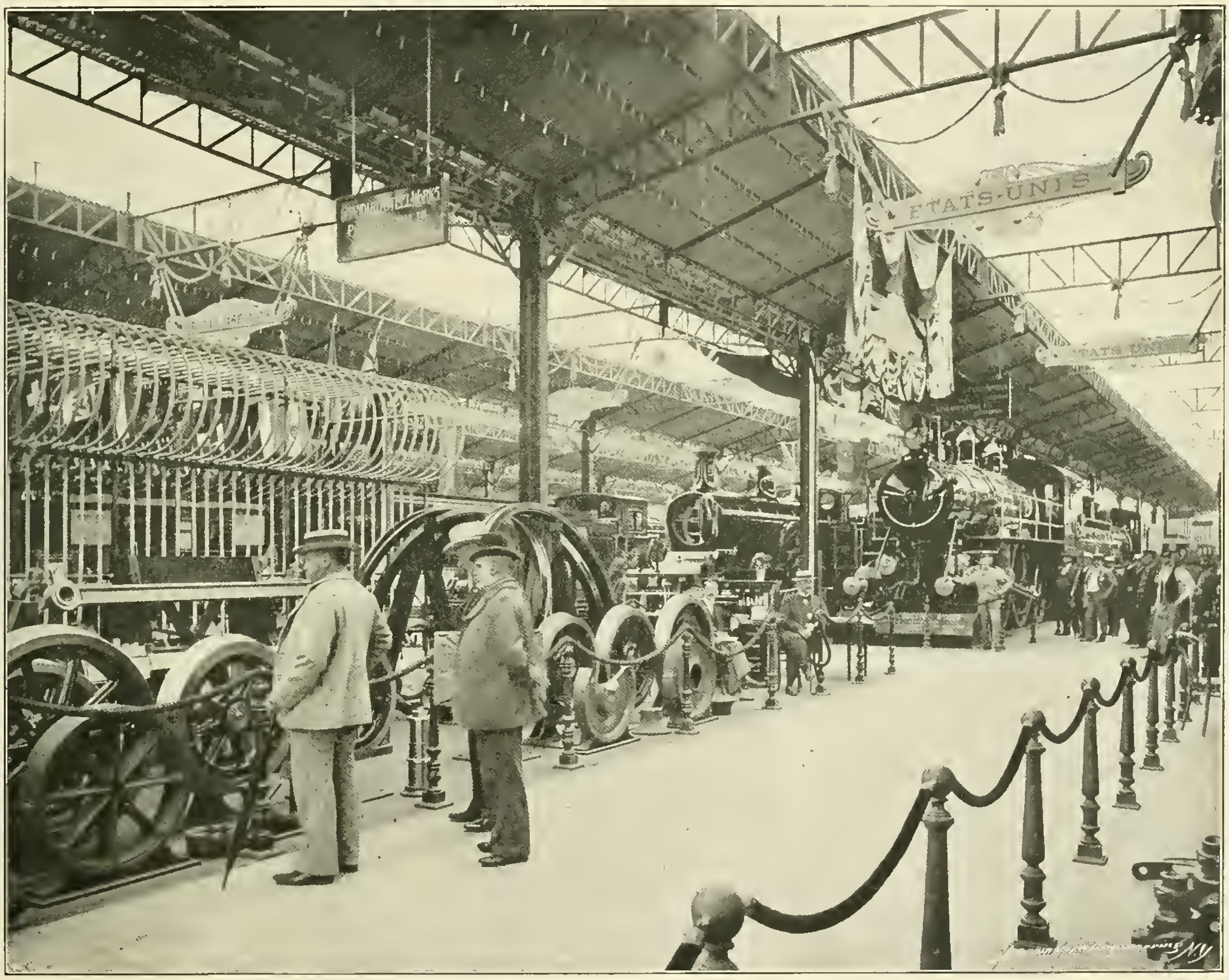
On wood-burning locomotives dampers that close airtight are just as much a fuel saver as steam-tight valves or good cylinder packing rings. Wood burns so freely that, with what natural draft there is in a locomotive boiler, a firebox full will soon burn out with the throttle shut off, provided the damper is open or there are any air leaks around the pan that let fresh air get up into the fire. If the pan can be closed up airtight, a firebox full of wood will smolder for hours and the steam not pick up a pound, which shows that the fire is giving off very little heat.

Coal burners are not handled that way. Here it is generally understood that it is the free circulation of air under and up through the grates that keeps them cool so they won't melt out. Possibly for that

DOWN THE BANK. THESE BIG ENGINES GIVE THE WRECKERS NEW PROBLEMS TO SOLVE. NO EASY JOB RAISING A 100-TON ENGINE OUT OF THE MUD.

reason no attempt is made to keep the pans tight. We will not dispute that fact, as a very thin fire of live hot fuel, like Pocahontas coal, will melt the grates at times, or if the ashes fill up the pan so they touch the grates and cut off the circulation of air under and through the grates they suffer. When lying in side tracks it takes considerable coal if the air passes up through the fire steadily.

Our English cousins look after the dampers pretty closely, making the ashpans air-tight when possible, fitting the dampers so they can be opened and shut from the deck. We do not hear very much about their grates burning out.



EXHIBITS OF BALDWIN LOCOMOTIVE WORKS AND STANDARD STEEL COMPANY AT PARIS.

Air-tight front dampers come very handy when running through snow. It is worth while looking after that matter before winter comes on, and see that both of them shut tight, as well as open wide. On many roads where fire flying from the ashpans is liable to do extensive damage, netting is put over all the air openings to prevent any fire getting out. We have seen these nettings so completely stopped up with leaves when running through a forest in autumn that they were taken off. The draft of air into the pan took the leaves along against the netting, which was soon stopped up.

Another kind of a draft regulator (we cannot call it a damper) comes very handy. When you have backed the engine into the house after cleaning the fire, if she is not to be moved, cover the top of the stack so no air can come out there. This stops the circulation of cold air up through the empty firebox and through the flues. The draft of cold air is responsible for a good many leaky engines. Try it on one of your engines with tender flues, and note how much it helps her in this respect. It will stop the leaking by keeping the firebox and flues warm till you are ready to fire up again. A cover for the top of the stack, if made of wood, is easier handled than one of iron when putting it up or taking it down.

Central New England Shops at Hartford

The shops of a small road are nearly always interesting, as where the latest tool cannot be had, the ingenuity of the mechanic must be brought into play.

The outside appearance of the Central New England shop at Hartford does not give one the idea that he is on Fifth avenue, but it is ahead of many larger shops in some respects, and Master Mechanic Schaefer hopes for a new shop in the spring. He is using compressed air quite extensively, having recently installed a New York air compressor, and is using old boilers for storage reservoirs. He has also done away with stationary engines for driving the tools, and has been using Westinghouse induction motors for the past eight months. These have no commutators, and so need no attention, except oiling, and it is interesting to note they have, as yet, not cost a cent for repairs.

Mr. Schaefer has just overhauled one of his 18 by 24 engines, so that it is practically a new machine, only the original wheels, frame and valve motion remaining, and the cost was far below the price of a new engine.

This emphasizes once more the rather remarkable life of the average link motion. When we consider that it is doing business at a lively rate hour after hour, and is exposed to dust, sand and other destroyers, together with the usual poor facilities for lubrication, the valve motion seems to be cared for by a special guardian angel.

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Softening of Feed Water.

The remarks which we have published at various times lately about the indiscriminate use of soda ash for softening feed water has brought us several inquiries from friends who wished to find where we stand on the question of softening hard water. In answer to this, we would say that we advocate railway companies doing their best to obtain soft water from natural sources, and, failing in that, to have the water treated with reagents that will precipitate the solid impurities that do so much to shorten the life of a boiler. Locating engineers and those in charge of the water supply of railroads are now beginning to recognize the importance of using every effort to obtain good feed water for locomotives, but sentiment on the subject needs to be stimulated. The usual plan has been to take the water that came most conveniently and let the mechanical department wrestle with the impurities. This wrestling was often done with very little knowledge how water could be softened. They knew that scale was damaging the heating surfaces of the boilers, and many people would resort almost to anything recommended as a remedy. Through this a great many mechanical purifiers were adopted, to be thrown out later as worthless, and any quantity of compounds was purchased and applied to the water without effecting a remedy.

Some companies treat the boiler water systematically for the removal of lime and magnesia, but each water station receives treatment to suit the water. They have the water analyzed by competent chemists who recommend the reagents to be applied and the quantity per thousand gallons. Where that is done the softening of feed water pays.

The Smoke Nuisance in the British Isles.

For many years a curious anomaly prevailed in Great Britain concerning smoke prevention. When railways were first inaugurated there was decided public prejudice against them, which resulted in the enactment of laws which were intended to embarrass railway companies and to render railway operating as difficult as possible. Public speakers and the press did all in their power to foster the prejudice and endeavored to influence the lawmakers against railways. A common prediction was that the smoke caused by locomotives would blight the farmers' crops, paint all buildings black, and taint the air with poisonous gases to the extent that the health of the people would suffer.

A band of determined, progressive men were on the other side. They advocated late and early the construction of railways, and reasoned with vigor against the predictions that the smoke from locomotives would do any more harm to the country and to health than the smoke from domestic fireplaces. This did not, however, prevent the lawmakers from passing stringent laws imposing heavy pains and penalties upon railroad companies guilty of the iniquity of using locomotives that caused any smoke. The laws were so severe in this respect that the early railway managers had no other alternative than use coke for fuel. This did not matter much at first, when rates were high and competition had not come into existence, but a time arrived when economy and reduction of expenses became powerful sentiments, and under their pressure various inventors proceeded to design smoke-preventing fireboxes. By using the best of these, railway companies gradually adopted coal for fuel instead of the highly expensive coke, but the public authorities never let up on prosecutions for smoke nuisance, and woe to the fireman whose carelessness or want of skill violated the smoke prohibiting laws.

In the meantime, when railway companies were under constant persecution for causing smoke, factory and metallurgical furnaces continued to pour out volumes of black smoke of a density that no locomotive ever approached. When agitators arose to compel owners of stationary boilers to stop beclouding the air and painting cities black with the smoke ever pouring from their furnaces, they one and all declared that smoke prevention was impracticable. They pretended that if laws were passed compelling them to run their business without causing smoke that they would be ruined. There is so much respect in the British Isles for property invested rights that the boiler users had no difficulty in getting public sentiment excited in their favor. It did not matter that progressive men pointed to locomotives burning bituminous coal without smoke and demanded why stationary furnaces could not be fired in like manner. Sixty years ago C. Wye Williams invented a smoke preventing furnace which he urged upon the attention of boiler users without success. They would have none of it. Being an irrepressible sort of individual Williams resorted to the pen when personal persuasion failed, and he wrote an elaborate treatise on the "Combustion of Coal and Prevention of Smoke," that after many years helped to lead public sentiment around to the belief that clouds of black smoke were not a necessary accompaniment of coal burning in a furnace. Fairbairn, the celebrated engineer, denounced the boiler users of Manchester in scathing terms for the injury they were inflicting upon the city and for the waste of fuel caused by their badly constructed furnaces and reckless methods of firing, but his was merely a voice crying in the wilderness. Other scientific men, however, took up the cry, and kept it up until legislation was passed providing for the punishment and repression of the smoke nuisance. British laws, when once passed, are nearly always enforced, but those against the smoke nuisance were in nearly all cities permitted to fall into desuetude. Of late, however, the reformers have been actively at work, and prosecutions for causing smoke nuisance are of daily occurrence. The delinquents do not any more offer the plea that smoke prevention is impracticable. They try to mitigate the fines by offering the excuse that their regular fireman was sick and they had to employ an unskilled laborer, or that an accident happened to the furnace which prevented the fireman from doing his work in the usual skillful manner. But a great change has taken place in the leading British cities, and grass and verdure are now green on places which formerly were soot-covered wastes.

There is a daily paper in Chicago which employs a photographer to take every day a picture of some smokestack that is pouring the stream of smoke that is so rapidly painting all buildings a sombre black. This picture is published the next day, and it stands forth as a silent witness whose testimony cannot be denied. It forms an excellent object lesson, and keeps the public conscience awake to the smoke-producing enormity. We commend the plan to the people of British and other American cities who object to their houses and public buildings being disfigured with the coating that black smoke slowly, but surely, imposes.

The Ton-Mile Basis for Motive Power Statistics.

At the last meeting of the Master Mechanics' Association quite a lengthy report on this question was submitted by the committee, and discussed by the members.

The differences of opinion were not so much about the advantage of this basis as compared with the engine-mile basis, as in regard to the details of working out the figures. So many of the roads have followed the engine-mile basis for years that it will be hard for them to make the radical change from a system which does not attempt to show the amount of work done for every mile the engine runs, whether empty or loaded—light or with a train—to a system of accounting that aims to show the amount of work done by each engine, and let the cost of doing that work be worked out from another set of accounts, which the ton-mile basis will do.

The account of work done on a ton-mile basis must of necessity be kept by the traffic department, in much the same manner that the mileage of the cars is kept. This will apparently impose extra labor on that department, but the results will pay the company at large, for whose good all departments are expected to work in harmony. With a ton-mile basis close comparisons can be made of the particular engines and men on each division, and due credit given for good work. The work on different divisions can be compared and the effect of the varying conditions compared. In this way unfavorable conditions can be changed to favorable ones whenever possible. With an engine-mile basis it is never known whether the division making the most engine miles is making or losing the most money for the company, as the element of work done is left out of the calculation.

On some lines the work done is shown in tons of freight handled per month, without showing whether this freight is hauled one mile or the whole length of the road. By the engine-mile basis the high engine mileage per month was looked for, whether it was all profitable or not; by the ton-mile basis the profit per engine will be looked after.

A portion of engine mileage will be made with the light engine. Unless credit is given for the weight of the engine and tender it will be lost sight of in the average of the loaded miles. When the true amount and cost of light engine miles and mileage of partly loaded trains is shown correctly, a closer watch will be kept of train movements which do not produce any revenue. The tonnage rating had something of a struggle to get a good foothold in railroad operations, but it is now well established. No road having given it a fair trial is liable to go back to the old system of rating by cars without regard to weight.

With the tonnage rating the locomotive and traffic departments worked together and achieved a success they could not have done. Just the same, the ton-mile basis will make its way, and be as successful in showing a profit in its operation as the tonnage rating has, but it will take the co-operation of both the operating departments that handle the rolling stock. It will substitute an exact system for work done for a system of guesswork as to which machine is making and which one losing money.

The Repetitions of History.

That every new industry has about the same course to run is shown if we look back at their history. First comes the discovery or invention, the scoffing and jeering of the conservative element, the experimenting to remedy defects, then the opposition of those whose business is affected if it succeeds. At this point the attention of inventive minds has been turned in this direction, and patents multiply as well as factories or shops for their manufacture. Competition becomes keen, those best established in the business succeed and the others fail, until a few large, well-known concerns are supplying the country.

This has been the history of locomotives, sewing machines, bicycles, and bids fair to follow in the case of the automobile. All were laughed at, opposed by teamsters, seamstresses and horsemen, and were made by numerous concerns at first. From 1830 to 1850 there were probably fifty shops building or attempting to build locomotives. Jewelers, blacksmiths, carpenters, anyone who could wield a hammer or thread a bolt, started to build locomotives. Maine had one or two works, New Hampshire one, Massachusetts more than we recall; but Boston, Lowell, Springfield and Taunton were all represented, as well as others. Paterson, N. J., had three, Philadelphia two, and almost every town east of the Mississippi took a turn at it. Now the number of firms can be counted on the fingers of the hands.

Sewing machines followed suit, and the history of bicycles is too recent to recall, but the similarity in many ways can be recalled to advantage, and it seems to emphasize the old saying that "History repeats itself."

It is reported that the Adams Express Company will take the place of the Long Island express on the Long Island Railroad, now that the latter property is owned by the Pennsylvania. This will make a uniform service over both roads.

At the Paris Exposition.

EDITORIAL CORRESPONDENCE.

PARIS, July 25, 1900.

We have heard so much in America about the backward condition of the exhibits in this Exposition, that I was prepared to find workmen busy getting the place into shape, but I was pleasantly disappointed to find everything in perfect order. I have been visiting exhibitions for the purpose of writing about them for thirty years, and I have seen a good many great shows in that time, but this Paris display is the finest that I have examined. It is decidedly finer than that held in Paris eleven years ago, and represents in a graphic way the progress made in the arts and sciences during that period. There is no mistake but that the French people know how to produce a striking exhibit, even if they make other people pay for it.

The display on the Champ de Mars seems to embrace specimens of every necessity and luxury that supply the needs and gratify the higher tastes of mankind, and in hundreds of cases the machinery and appliances employed in producing the articles exhibited are to be seen at work. It is not my intention in this letter to go much into details, but merely to give general impressions.

After taking a leisurely walk through the buildings where engines, electrical machinery, machine tools, textile machinery, mining machinery and railway machinery are displayed, the most conspicuous impression received is, the great increase of size and weight that has grown up even since the World's Fair at Chicago. This has been particularly marked in the case of locomotives and passenger cars. The exhibit which the Pressed Steel Car Company, of Pittsburgh, makes at Vincennes gives the world an idea of what the United States are doing in the development of freight cars; but the freight cars exhibited by railway companies display no increase of size worth mentioning, and no improved appliances for the safe handling of cars more than were to be seen in the Exposition of 1889.

The mention of Vincennes brings up a matter which all visitors interested in transportation of machinery exhibits view with more or less indignation. The Exposition proper is held in the Champ de Mars (Field of March), a vacant stretch of ground conveniently situated on the banks of the Seine River, which cuts Paris in two, just as the Chicago River cuts Chicago. That field has been preserved because the space is used for drilling soldiers and forms a sort of annex to the Military School and of the Invalides; the latter a military establishment noted as being the resting place of the first Napoleon. But the space is far too small for a huge exposition, and various buildings are planted along the sides of the Seine and on any space that offered room for them. There is in the Champ de Mars, called the Génie Civil et Moyens de transport, which ought to be the Transportation Building; but it is filled with road carriages, automobiles, bicycles and other vehicles which do not run on railroads.

The Transportation Building proper is called an Annex, and is located near Vincennes, outside of the fortifications, six or seven miles away from the Exposition proper. It is like placing the exhibition in Central Park, New York and the transportation annex in Battery Park. The distance is not the worst of it; but the transportation facilities, which are of the slowest kind, take up a great part of the business day in going and returning. The ordinary way is to go by boat on the Seine, which stops about every half-mile, and the visitors landing at the pier nearest to Vincennes take a street car for about two miles. There has been an underground electric railway opened this week, which will make things a little better; but it does not go within two miles of the Annex.

A movement was made, mostly by Americans, to put fast non-stopping boats on the river to carry passengers from the Champ de Mars to Vincennes, but the established interests in other lines of transportation defeated the scheme.

The Vincennes forest is a most inconvenient place for transporting heavy machinery, and Americans appear to have suffered badly at the hands of the railways whose tracks connected with the exhibit grounds. High charges and incomprehensible delays were encountered by all foreign exhibitors except the Russians. There is a sentiment among Frenchmen at present which prevents them from putting impositions upon the Russians. There is an idea, on the other hand, among the French that nearly all Americans are millionaires, and they are regarded proper objects of exaction.

There were two contending interests which had some sort of a pull with the authorities in handling freight destined for the exhibition, and it frequently happened that when one concern was engaged to do the work the other had to be bribed to let the goods be moved without interference. From what I heard about these doings, the politicians who manage Paris could give pointers to the worst boodle-inflicted cities in America.

The Schoen people met with tremendous difficulty in getting their cars transported from Havre to Vincennes, and it was only by superhuman efforts that they were got to the Exposition. The Western Railway of France refused to haul them on the pretext that they were too low for certain switches and bridge guards used on the road. After wasting much time and money in trying to convince the officials of the Western Railway that the cars were not low enough to strike anything connected with the permanent way, the Schoen agent determined to float the cars up the Seine from Havre on barges, and that was done. The distance must be more than 200 miles.

The Richmond Locomotive Works seem to have fared even worse than Schoen's people in their attempts to have their engine taken from Havre to Vincennes. Yesterday I learned that the dismembered engine had arrived on cars at a station near to the Exposition, and that the railway company were demanding $430 for lifting the parts off the cars.

GENERAL VIEW OF PARIS EXPOSITION—CHAMP DE MARS.

The principal buildings in the Champ de Mars form a long parallelogram, with flower plots, fountains and art objects in the open air between the buildings. A small edition of the big building is to be seen at the Esplanade des Invalides, about a mile away. The means of getting about are decidedly slow, and consist principally of an elevated moving platform, which passes close to the principal buildings and carries people at the rate of six miles per hour. In addition there are wheel chairs pushed by men, much the same vehicle as that used in the Chicago Exposition. A person anxious to see everything has a fine opportunity for developing his walking abilities.

In starting out to go through the Exposition buildings I aimed to obtain a general idea of what was to be seen, but particularly what was installed by Americans. Through the courtesy of Mr. Willard A. Smith, one of the United States Commissioners, I obtained a map showing in red the spaces devoted to United States exhibits. The map proved very useful, and saved many weary steps. Incidentally I might mention that the weather is horribly hot, and moving about all day in those glass-covered buildings, with no circulation of air to speak of, was a weariness to the flesh.

Starting from the Eiffel Tower and taking the central aisle of the left wing, one soon comes in sight of the stars and stripes, and under the flags a wonderfully fine mining and metallurgical exhibit, installed by the United States Government. Many of the cases in this exhibit have been prepared by universities and other educational establishments. They have certainly made up a display that the country has reason to be proud of. It will also give visitors an idea of the amazing mineral resources of the United States. Strangely enough, the exhibits of coal are quite inadequate to give any fair impression of our heat-producing minerals. A gentleman interested in this department remarked that when they arranged for their display of coals it did not seem important to show Europeans the coal resources of America, as there seemed no near prospect of sending much coal from the United States to Europe, but that the South African war and other unexpected events had suddenly opened a good market in Europe for our coal, and that now they regretted having such a meagre exhibit. This same gentleman also gave an illustration of the need there was of spreading in Europe information regarding our country's resources. An English gentleman, evidently above the average intelligence, stood in the exhibit and was particularly attracted by the finished articles of steel and copper. "These things are very handsome," he remarked, "but what are you Yankees going to do when we refuse to sell you more coal?" It turned out that this representative innocent was under the belief that coal was found nowhere out of the British Isles.

In following our journey the next time our eyes are refreshed with a sight of the soul-stirring stars and stripes is in connection with a textile group, where various American manufacturers of textile goods demonstrate that their home skill and ability are sufficient to convert the raw material grown in American fields and raised on animals that roam the American fields, hills, plains and forests, into finished products that excite the admiration and envy of European connoisseurs.

Before reaching the next red spot indicating American exhibits, we come among a lot of very heavy electrical machinery, some of the engines and dynamos being the most ponderous machines of the kind I had ever seen. An amusing piece of American enterprise was witnessed here on every hand and was in evidence in all parts of the Exposition where heavy or fast-run machines were at work. It was notice boards placed in conspicuous positions, reading, "This machine is lubricated with valvoline." Leonard & Ellis spent their advertising funds to good advantage at this exhibition.

In the Machinery and Electricity section, graced by the American flags, there are many minor exhibits belonging to those who make machinery for railroads; but in nearly every instance these are specimen exhibits, the principal displays being made at Vincennes. I heard bitter complaints about this arrangement that

A CLOSER VIEW OF THE GROUNDS AND BUILDINGS, PARIS EXPOSITION.

compelled people to make double exhibits. When complaints were made the men in authority would say, "You do not require to make two exhibits," which from the officials' standpoint, was true, but from the interest of the exhibitor was entirely misleading. The space in the Champ de Mars was so limited that none but Russians could obtain room for a good display of tools, and so they had to take space at Vincennes. But they were aware that many probable customers would not go across the globe, so to speak, to Vincennes, and so they were compelled to install an exhibit in the main building to attract interested visitors, and when they took the bait and were anxious to see more of the tools made by the same firm, it was not difficult to steer them to Vincennes.

In making the tour of the main buildings we pass through the agriculture and food groups, also the annex to that department, and a variety of others, such as that devoted to heating and ventilation, to chemical industries, to civil engineering and transportation (Genie Civil et Moyens de transport), which ought to have contained the finest specimens in the development of transportation appliances, but contains merely specimens of light vehicles, some of them by no means practical devices.

Near here, in the French part, are some of the pioneer French locomotives, for which absurd historical claims are made. One, built in 1831, has inscription exhibited, claiming that it was the first locomotive that had a multi-tubular boiler.

The next department seen is Liberal Arts, then, as part of it, Education. That completes the tour of the main building; but I feel like returning to say an extra word about the agricultural and food exhibit, which was prepared by the Agricultural Department of the United States Government. It is the most comprehensive exhibit of matters relating to the raising of agricultural products that has ever been shown at an exposition. I visited the section several times and always found groups of people examining the cases and asking for information about the prospects of engaging in agriculture in the United States. I believe that the agricultural exhibit will be the means of bringing many desirable immigrants to the United States. S.

A train on a Pennsylvania road recently consisted of thirty-three steel cars of 100,000 pounds capacity and thirty-seven 80,000-pound capacity wooden cars, each loaded full with anthracite coal, the total weight being 4,567 net tons.

HALL IN THE GRAND PALACE. A FINE EXAMPLE OF STRUCTURAL IRONWORK.

Burning Coke in Locomotives.

We have had numerous inquiries as to coke burning on locomotives, and a recent visit to New England gave an opportunity to get some information on the scene of action. As is probably quite well known, the Boston & Maine road is burning it to a considerable extent, and the Boston & Albany are using it on shifting engines in and around Boston. This is a plan, by the way, which might well be adopted elsewhere, as it does away with much of the smoke too often found in city yards.

Burning coke in a locomotive is not new—in fact, some of the first contrivances that were called locomotives burned it, and it has been tried at different times by various roads, among them the Baltimore & Ohio, about ten years ago.

In the case of the New England roads there is a huge gas company near Boston, which has an immense amount of coke as a by-product and could make a very attractive price on it. So the Boston & Maine took advantage of this and began introducing it on their passenger engines.

In the first place, they used a grate containing numerous water tubes for fear of burning things up, but they are now using the regular soft coal firebox, with no alteration except knocking the ends off the fingers, so as to give more air, and sometimes this isn't necessary—they burn off if run a few trips. They plan to keep a little water in the ashpan to keep the grates from burning, and also turn the air pump exhaust in under the grate.

Getting up steam with coke is, I am told, a much longer job than you would think—longer than with soft coal. They say it isn't safe to allow under an hour and a half, and that two is better.

Firing coke can be compared to a storage battery or a compressed air car. You fill up the firebox at a station and let it burn till the next stop is reached, as the fire door wants to be kept shut when you are working the engine hard. After you stop, it is time to "bale her full again and put on blower till you start," as several of the men told me.

This explains why it is not used on the longest runs or trains making very few stops with the same success as on short runs. If you stop often enough to keep the fire in good condition, it works very nicely, but if the fire is run too long and gets "down," you have troubles of your own in getting it up again. Another rather peculiar feature is that it has been found necessary to reduce the nozzles in some cases—and yet when we consider that in this case it is "gas" coke, or coke with some of the heat-giving gases removed, part of the peculiarity disappears.

The amount burned to obtain the same work from the engine varies according to its qualities and the way it is handled, same as with coal. Estimates were given at from 10 to 40 per cent. more coke than coal, which is not excessive, depending of course on the quality in any case.

There is no question as to its being more desirable for switching around a large terminal than soft coal as usually burned, and for such work the question of cost is not so vital as some seem to imagine, although the difference would be slight. And the fact that much, if not most, of the smoke around terminals is caused by yard or local engines would indicate that this might be at least a partial solution. C.

The Great Central Railway of England have their dining cars decorated by etchings which are real works of art. All other passenger cars have every compartment decorated by excellent photographic views of scenes on or near the line, most of them representative places that are of historical interest. This is a common practice with all British railways, but the Great Central have carried it to the greatest perfection.

Not Tired of Royalty.

Although there is a belief among certain badly informed people that the British nation is tired of royalty and would gladly help to inaugurate a simpler form of government, there is no evidence over there of a desire for such a change, except among a small group of the people who are always against the government and are a nuisance to people of every country. A visitor cannot spend many days in Great Britain, if he keeps his eyes and ears open, without seeing and hearing evidences of the people's love for royalty.

One day, not long ago, a foreign potentate was a guest of Her Majesty Queen Victoria, and the Prince of Wales escorted him to the Guildhall to introduce him to the Lord Mayor of London. The Guildhall is in the heart of the city of London, in a court off one of the busiest and most crowded streets in the world. A visit of royalty to the city entails the stoppage of all public vehicles till the visit is past. On that day the Prince and his guest were pleased to ride in a closed carriage with the blinds down, but the multitude assembled to witness the sight of royalty, cheered vociferously as long as the carriage was in sight, and then waited quietly and patiently in the closed streets until the visit was over. The only expression of

BUILDINGS OF THE FOREIGN NATIONS, UNITED STATES SECOND FROM LEFT.

disappointment we heard was from a costermonger-looking man, who remarked that it was "a blooming long wait for a bloody short show."

When the Queen goes out, careful precautions are taken to guard her against accidents and from the homicidal intentions of cranks and anarchists. This is particularly notable when she makes a journey by rail. The line is kept clear for half an hour before the royal train is due, and a pilot engine runs ahead to see that no obstruction is put upon the track.

When railways were yet in their infancy, but were reducing the discomforts and time needed in traveling by coach, the question came up before the Queen's advisers: "Would it be safe to permit Her Majesty to travel on a railway?" After long deliberation it was settled that the Queen might try a trip from Windsor to London by a special train. The most careful engine driver to be found was appointed to run the engine, and a uniform speed of 20 miles an hour was agreed upon. The journey was made very smoothly at the speed ordered. When the train arrived at London, Prince Albert, the Queen's husband, went forward and praised the driver for his care and skill, but he added, "Not so fast next time."

The Reverse Lever.

Since the Sand-House Committee put the question to the old engineer about getting steam into the cylinder at the right time, and studied over the meaty points in his answer, their attention has been taken up more by matters of interest in the mechanical line and less by a desire to arrange the management of the company.

One of the "graduates," who has passed the examinations, stumped the whole committee by asking "What is the indispensable tool on a coal burner?" When, after a long argument by all hands, some of whom insisted that at least fifty tools were indispensable, he told them "it was a scoop," the next question was, "What is the reverse lever for?"

The old engineer answered that question in this wise: It is to change the position of the link on the link block, so the distribution of steam can be changed, to make the engine move either forward or backward and to use a greater or less amount of steam at each stroke of the piston, by changing the point of cut-off of the live steam.

How does it do this? you ask. Well, the upper end of the link is usually connected to the go-ahead eccentric; the lower end to the back-up one, and therefore one end of the link is intended to give the proper movement to the valve for going ahead, the other for backing up. Changing the position of the link in regard to the link block will change the movement of the valve in relation to that of the piston.

One advantage of the link is that it can be used in any portion of its travel up and down on the link block, as well as to reverse the motion of the engine.

When the block is near the middle of the link, it gives the block a shorter travel, and consequently the valve has a shorter travel, giving a shorter steam port opening. In this position the block has part of the motion of the go-ahead eccentric and of the back-up eccentric. This combination of movement gives a motion to the valve which can be greatly varied by changing the lead given to the valve by the position of the eccentric cams on the axle.

Does the reverse lever have anything to do with the slip of the block up and down in the link when the engine is moving? No, it does not; that is governed by the position of the points of suspension of the link and of the block. The link is suspended by the link hanger from the end of the tumbling shaft arm, and travels in a path or arc which changes a little as the link is raised or lowered by the reverse lever. This arc of the link changes a great deal more in respect to the path of the link block as the block gets nearer to the end of the link and the slip of the link is more at full stroke than at a short point of cut-off. The link block is fastened to the lower end of the rocker arm and always travels in the same path, sometimes full travel, sometimes short.

Does it make any difference if the tumbling shaft is located below the link instead of above, as some very old engines had it placed?

Well, it does make a difference, because the link swings from a point below the center instead of above. The rocker arm swings from a point above the middle of the link, so that the paths of the link and link block diverge more than when the tumbling shaft is above both of them.

UNITED STATES BUILDING AT PARIS EXPOSITION.

Why are the new reverse levers made for such close notches in the quadrants?

So as to have a less difference between the many points of cut-off that can be used by hooking the link up. In many cases these extra close notches are not taken advantage of by the engineer. As soon as he finds out a certain notch where the engine does her work easily, he uses that one all the time.

How do you handle an engine when anything is broken so the reverse lever will not move the links?

If only one link is uncoupled from the

reverse lever, as will be the case when a link hanger is disabled, block that link in the slot both above and below the block, down pretty well, so you can start the train when going ahead. If you have to back up, change the blocks and raise the link up. Be very careful not to drop the other link down with the lever or the tumbling-shaft arm may catch on the top of the link that is blocked up; this means trouble. If a tumbling-shaft arm is broken, never mind; it won't strike. If the reach rod is broken, block up one link and let that carry both of them. Do not block both links solid, as the slip of the link blocks is not even. If both are blocked solid it will surely strain the tumbling shaft.

What will you do when the reverse lever gets caught so it cannot be moved, as is the case sometimes with a broken driving spring or hanger?

Get out the pin that couples the reach rod to the top of the tumbling-shaft arm, if you can. This will let you move the links and get the engine out of the way. Or you can uncouple the link hangers to go ahead.

Can an engineer get this pin out?

Well, that is a hard question to answer.

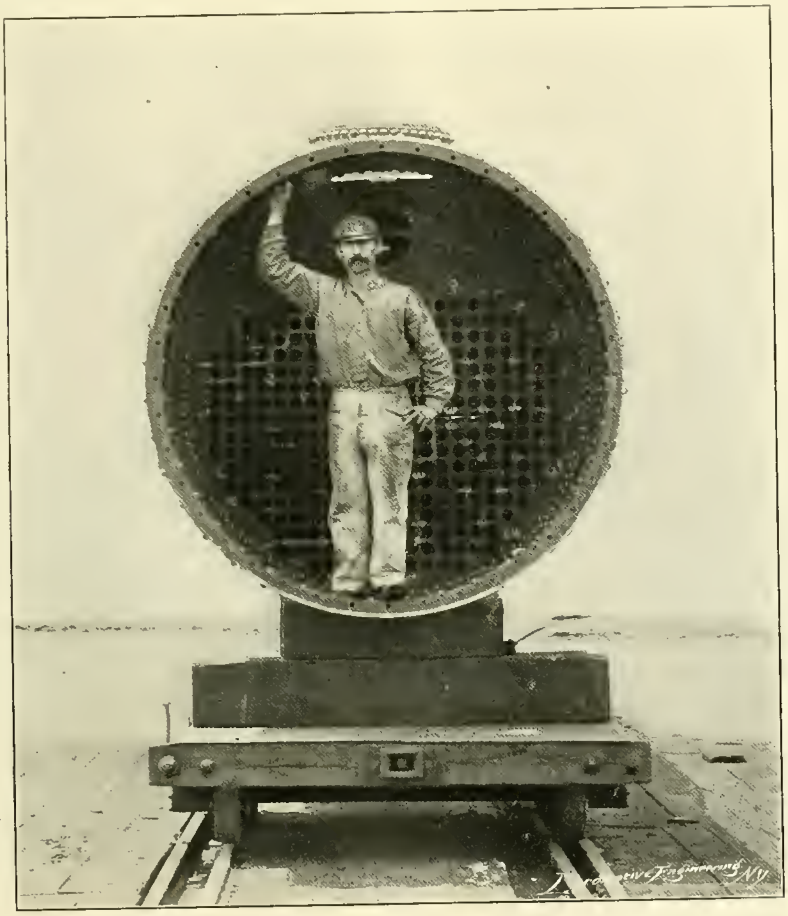
The new edition of our "Book of Books" is about ready for distribution—better get a copy.

Consolidations for the Rio Grande Western.

We illustrate with this one of a lot of eight consolidations just turned out by the Richmond Locomotive Works for the Rio Grande Western Railway. The boilers are of good size, as indicated in the cut showing the front end of one of them; they are 74 inches at the first course. All the engines are identical, except that four have drivers 50 inches in diameter, the remainder being 6 inches larger. The general dimensions are given below:

Weight on drivers—168,400 pounds.

Weight in working order—185,000 pounds.



FRONT END OF RIO GRANDE WESTERN BOILER—74 INCHES AT FIRST COURSE.

Wheel-base—Driving, 16 feet 8 inches; total, engine and tender, 52 feet 11 inches.

Total length of engine and tender—63 feet 2¼ inches.

Cylinders—22 x 28 inches.

Steam ports—1⅝ x 21 inches.

Exhaust ports—3¼ x 21 inches.

Bridge, width—1½ inches.

Valve—Richardson balanced.

Greatest travel—6 inches.

Lap—Outside, 1 inch; inside, 0.

Lead in full gear—1-32 inch.

Driving axle journal—9 x 12 inches.

Crank-pin, main—Steel, 7 x 6½ inches, 7¼ x 5⅞ inches.

Crank-pin side rods—Steel, 5¾ x 4½, 5¾ x 4¾, 6¼ x 5⅜ inches.

Truck journals—6½ x 10 inches.

Boiler pressure—185 pounds.

Outside diameter, first course—74 inches.

Firebox—Length, 122 inches; width, 41 1-16 inches.

Tubes—Iron; length, 14 feet 2⅞ inches; number, 318; diameter, 2¼ inches.

Heating surface—Tubes, 2,667 square feet; firebox, 206 square feet; total, 2,873 square feet.

Grate Area—34.7 square feet.

Top of stack above rail—14 feet 8½ inches.

Weight of tender, empty—43,200 pounds.

Journals—5 x 9 inches.

Wheel-base—17 feet 11 inches.

Tank capacity—Water, 5,000 gallons; coal, 10 tons.

A Sand Blower.

Raising sand from the ground floor to an overhead bin by compressed air is done at a great many railroad engine houses, but blowing it upstairs with a fan blower is not very extensively practiced.

At the Pennsylvania Railroad engine house in Louisville, Ky., General Foreman Foster uses an old 40-inch fan blower for this work. A smaller blower would do the work, but as he had this one on hand it was installed. A 6-inch galvanized-iron pipe leads from the fan in engine room through the sand house to an elevated bin about 30 feet high. The sand flows from the bin under the sifting platform through a 1¼-inch pipe into the 6-inch air pipe, where the current of air takes it up the pipe, which lies at an incline of about 30 degrees, into the bin. The end of the sand pipe is curved to point the same way the current of air is traveling, so that the air does not blow up through the sand into the sifting bin.

At the top of the storage bin there is a pipe, 8 feet high, 12 inches in diameter, through which the air escapes. All the sand drops in the bin, while the loam and dust are carried out the ventilating pipe. Something over a ton an hour can be handled by this method. It is a continuous operation as long as the sand is running into the air pipe.

The fan is run only while the sand is being sifted into the lower bin, and it will not run into the air pipe unless the fan is running. The current of air seems to draw it through the curved nozzle.

Sand is taken from the elevated bin into the engine sand boxes through a pipe, the usual way.

The Rules of Interchange, as revised at Saratoga, N. Y., in June, which go into effect on September 1, 1900, will be ready for distribution about July 25, and will be furnished at the same rates as heretofore, viz.: 25 copies, $1; 50 copies, $1.75; 100 copies, $3; less numbers than 20 copies, at 5 cents per copy. Postage will be added in all cases when sent by mail. Address, Jos. W. Taylor, Secretary, 667 Rookery Building, Chicago, Ill.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(78) J. B., Omaha, Neb., asks:

Why do some engines have more lap than others? A.—An engine that is intended to work steam expansively usually has more lap than one which is worked nearer full stroke. For instance, a high-speed passenger engine has more lap on the steam edge of the valves than a yard engine. Then, again, the amount of lap is sometimes due to the ideas of the designer of the engine.

(79) North Western Fireman, Clinton, Iowa, asks:

What is the friction of fluids? A.—As we understand your question, it is the frictional resistance which fluids have to meet when flowing over or past stationary surfaces, like the inside of a pipe or the bottom of a passage or river. The particles or molecules of which a fluid is composed also have some little friction when moved among themselves; this friction is so slight that in actual practice it is not taken into account.

(80) J. B., Omaha, Neb., asks:

Can steam get into cylinders with reverse lever in the center notch? A.—That depends on the way the link motion and valves are designed; also on the way the eccentrics are set. If the eccentrics are set with very much lead the steam port will be open in any position when that side is on the center. If the valves are built without much lap it is a hard matter to place the engine so one or the other of the four steam ports will not be open for the admission of steam to the cylinders.

(81) A. M. G., Terre Haute, Ind., wants to know why the engine runs forward when the link is down, and backward when the link is up. A.—Because when the link is down the go-ahead eccentric is connected directly to the link block and the lower end of rocker arm, so the go-ahead eccentric moves the valve and the back-up eccentric is not connected to the rocker arm. When the link is raised up the reverse is the case. With the link raised part way up the link block and rocker arm take their motion from both of the eccentrics.

(82) N. B., New Albany, Ind., asks:

If engine, while shut off and running down hill 40 miles per hour, breaks main rod strap, why doesn't piston knock cylinder head out? A.—When running at a high speed there is considerable compression of air in the cylinder just at the end of the stroke, and of course a partial vacuum on the other side of the piston. When the force of compression amounts to more than the momentum of the piston and connections, the piston will not strike the head and knock it out. We would like to ask a question: What broke the main rod strap when engine was running shut-off?

(83) J. J. C., Brownwood, asks:

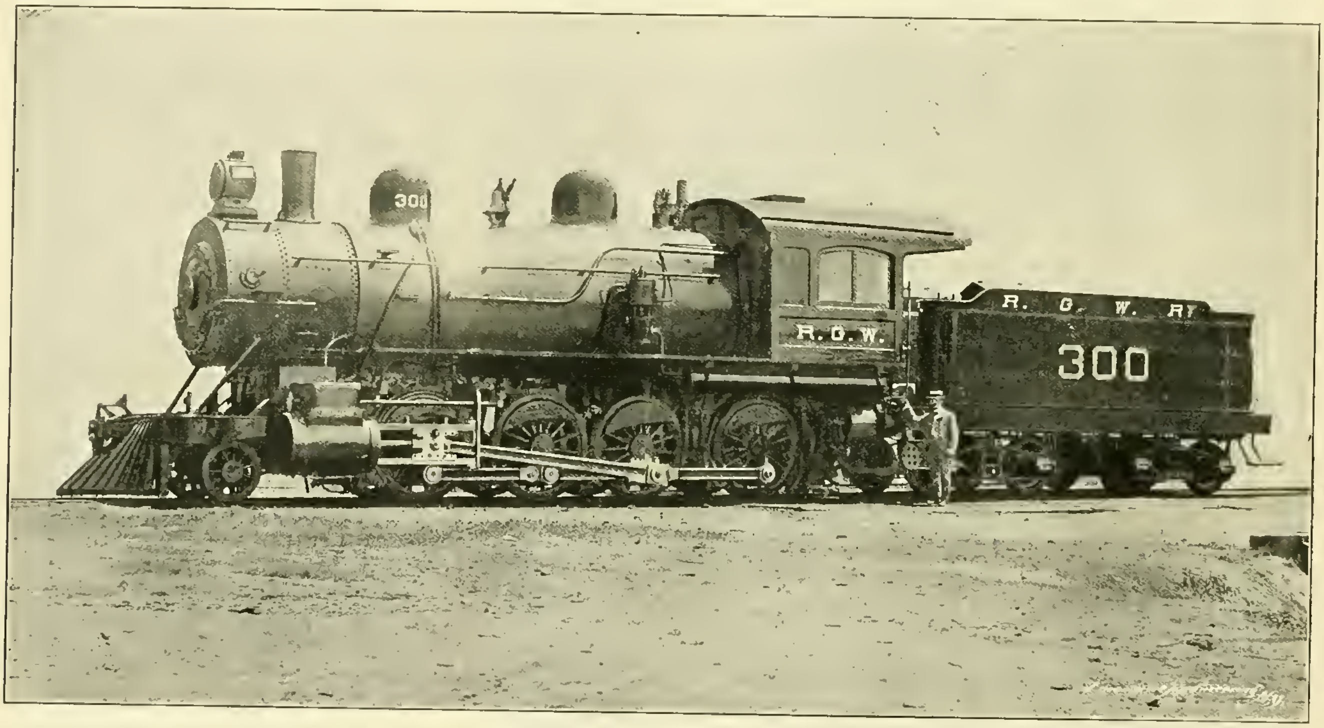
1. If an engine should knock off a main pin, why should side rods on opposite side be taken off? A.—1. They need not be if only going a short distance with an eight-wheel engine. If the engine has more than two coupled drivers, let the rods stay on. The matter is more fully treated on page 191, in the May issue. 2. If the side rods or pins are liable to break, at what time or point of the revolution, and why? A.—2. At the point when there is the most strain on them. This point varies with the different crank pins, as the strain may be more on the main pin at one time than the others, and more when backing up than when going ahead, more on one quarter than on the opposite one.

(84) J. R. A., Dubuque, Iowa, writes:

We have a discussion about the center of gravity of one of our ten-wheel engines. The drivers are equally spaced from center to center, and the distance from center of main driver to center of truck is 11 feet 6 inches. The weight on truck is 28,000 pounds; on drivers, 110,000 pounds. Where is center of gravity? A.—Assuming load on drivers to be centered over main drivers, and taking your figures, we have a total load of 138,000 pounds and distance of 138 inches. Multiply 138 by 28,000 and divide by 138,000, and we have:

$$\frac{138 \times 28,000}{138,000} = 28 \text{ inches.}$$

This is the location of the center of gravity ahead of the center of the main driver. This is proved by multiplying 110,000 by 28 and 28,000 by 110. If they are equal, the result is right, as it is the case of a simple beam balancing over the center of gravity. The same result will be obtained by multiplying 138 by 110,000 and dividing as before, except that the result will give the distance *back* of the truck center instead of in *front* of main driver.



RICHMOND CONSOLIDATION FOR RIO GRANDE WESTERN (SEE PAGE 395).

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

New Air-Brake Instruction Cars.

The International Correspondence Schools, of Scranton, Pa., have just put into service car No. 106, the third one of their new air-brake instruction cars which was built by the American Car & Foundry Company at their Jeffersonville shops.

These cars are 70 feet long over the sills, very strongly built, equipped with Standard steel platforms and buffers, Westinghouse friction draft gear, National combination couplers, Sterlingworth brake beams, Scott springs, six-wheel trucks of the Car Company's design, McKee-Fuller wheels, with Latrobe tires. They have accommodations for the staff of four air-brake men on the car, a cook and a porter.

The boiler, built by the Westinghouse Company, of Schenectady, is located in one end of the car. It is arranged to use two air pumps.

Each of the cars has a 9½-inch Westinghouse pump in the boiler room, one of the same kind working the upper steam head, and its valves, tandem, are located in the lecture room, where the class can see its operation.

Car No. 105 has a No. 2 New York pump in addition to the 9½-inch pump. Both of them are fastened to the boiler. The boiler is fed by a No. 1-A Ohio injector, a small duplex Worthington pump is also installed; either one or both can be used. The water supply of 600 gallons is carried in two tanks, located under the car, properly lagged and jacketed to prevent freezing. The supply of coal is in a coal box holding 1 ton, in the boiler room. A No. ?-A Detroit lubricator of the latest design oils each of the air pumps and the Worthington.

Next to the boiler room is a kitchen, then the dining room, and last the office, which is next to the instruction room.

The instruction room is 40 feet 6 inches long. At one end is a main reservoir, 22½ x 41 inches, set on end and used as a stand for the brake valves. Two other main reservoirs are under the car. The combined capacity of all three is 54,000 cubic inches. Cut-out cocks allow one, two or three of these reservoirs to be used at a time, as may be desired. Near the main reservoir, which is 6 feet from the end of the instruction room, are placed the tandem triple valves. The tandem F-6 brake valve is set on top of the reservoir; the tandem 9½-inch pump is at the partition. The illustration shows the location of these sectional tandems.

Two engine equipments are in the car. They can be coupled together to use as a double-header, or separately. One of them has all the high-speed attachments. A 12-inch coach brake with high-speed equipment is located near the engines.

Along the sides of the car are fifty sets of freight brakes, twenty-five on each side. The proper amount of train pipe is attached to each brake and located under the cylinders. There is a clear floor-space, 6 feet wide by 32 feet long, between the lines of train pipe. The piping is so arranged that the engine can be coupled to either end of the train, so the fiftieth car can be made the first from the engine.

On car No. 105 there are twenty-five New York triples on one side of the car, and twenty-five Westinghouse triples on the other brakes, to be used when instructions are called for on the operation of the New York equipment. The brakes are so arranged that either form of triples can be used by changing them on the auxiliaries. Cars Nos. 104 and 106 have no New York equipment.

The sectional valves are set on tables between the windows. A 9½-inch sectional pump and 8-inch pump are in the lecture room. All the sectional tandem valves were built by the Westinghouse Air-Brake Company.

The air-signal line of ten cars is in the clear story, with full length of pipe, hose couplings, etc., to represent actual conditions. Signal valves are near the instructor. There are plenty of gages, thirty-four single hand gages and three duplex being used. Break-in-two hose connections are located near the door.

A full engine equipment of the Pyle National electric headlight is installed on the car for instruction purposes. It will be utilized to light up the instruction room. The car can be lighted by either oil or electricity, forty-six incandescent 16 candle-power lamps being used and seven double Acme oil lamps. Where the electric current can be obtained the car will be lighted by electricity.

A Baker heater with McElroy commingler which can use fire, or steam from the boiler, heats the car. The foundation brake is equipped with high-speed reducing valve and McKee slack adjuster.

These cars are about as complete as can be made. They are intended to give the students of the schools as good a chance to study the operations of the air brake as is possible.

EXTERIOR VIEW OF THE AIR-BRAKE INSTRUCTION CAR JUST BUILT FOR THE INTERNATIONAL CORRESPONDENCE SCHOOLS.

Brakes Left Set Produce Flat Wheels.

The flat wheel is the most unwelcome and hostile incursionist in an economical performance sheet of a railroad. When flattened wheels manifest themselves (and they generally come like an epidemic), suspicion immediately falls on the air brake. The triple valve is examined and the levers measured up. Should these parts seem in sufficiently good shape to absolve them from blame, one man will look at the other and ask: "If the air brake isn't to blame for the flat wheels, what is?" There are numerous other causes known to the experienced air-brake man, who seldom fails to run down the real cause.

Recently some instructing and valuable tests were made by the railroad engineering department of the University of Illinois, which disclosed still another, and no doubt a frequent cause of slid flat wheels.

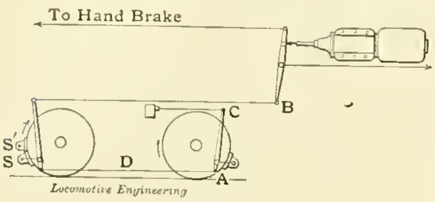


FIG. 1.

It was known that if the brake were set on a car at rest, and the car started with the brake set, the rear shoes would ride up on the wheels until stopped by the hangers. This action, it was believed, occurring when the levers and rods were in tension, would cause an increased pressure on the brake shoes, perhaps sufficient to cause wheels to skid. Fig. 1 illustrates this action. The shoe rising from S to S_1 increases tension in the pull rod. Verification of this belief was demonstrated by the tests.

In the tests there was a special brake beam, whose strut was provided with a steel cylinder and piston. The cylinder was filled with oil, and the live lever connected to the piston. Thus, when a pressure was exerted at the brake shoe it would be recorded on a hydraulic gage connected to the oil cylinder, as shown in Figs. 2 and 3. As brake shoes in service were observed to rise 1½ to 2 inches, the hanger holes were accordingly slotted to 2 inches, to give that rise when brakes were applied.

A quite exhaustive series of tests were made, but we shall give only those which bring the most important results. First, the hand brake was set with a force which registered 6,500 pounds on the hydraulic gage attached to the oil cylinder on the brake beam. The car was then started by an engine, the brake shoes on the rear wheels lifted and the hydraulic gage ran up to 10,000 pounds—an increase of 3,500 pounds, or 35 per cent. Then the hand brake was released and the air brake set to full pressure of 50 pounds per square inch, and the hydraulic gage registered 3,000 pounds on the brake beam. At this point the levers and rods were shaken, and the gage pressure increased to 4,200 pounds. When the car was started and shoes lifted, the dynamometer gage registered 5,250 pounds—nearly 60 per cent. higher than the initial pressure of 3,000 pounds.

Additional and miscellaneous tests subsequently made showed even greater differences between initial and final pressures, the increase of pressure due to the rise of shoe varying from 10 to 115 per cent. In one hand-brake test, two and a half times the calculated emergency pressure at the air brake was gotten on the brake shoes. In a similar test the hand brake chain broke. The highest percentage of increase was obtained by slacking back the car after it had been first started, and then starting forward again. These tests brought increases varying between 93 and 115 per cent.

These tests prove that greater possibilities of wheels sliding exist in yards where hand or air brakes have been left set than out on the road where wheels are popularly supposed to be ruined; and useful hints may be taken from them by the air-brake man whose duty it is to run down flat wheels.

Testing Worn and Repaired Triple Valve Packing Rings.

Editor:

I was quite interested in the articles of Messrs. F. B. Farmer and E. W. Pratt in your August number. They both agree

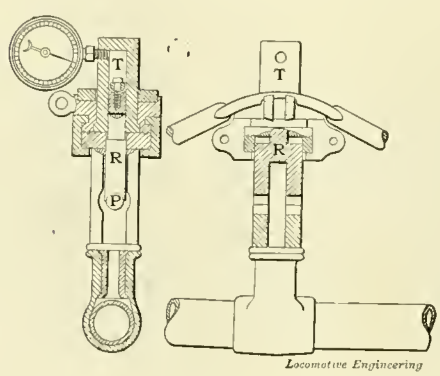


FIG. 2.

that it is good practice to test triple valves for defective packing rings, but do not give sufficient details of the test they find most satisfactory, to enable others to profit by their experience. At the Baltimore convention of the Air-Brake Association there was some discussion on this subject, but there seemed to be no definite decision arrived at.

During the past ten years I have given considerable attention to this matter, and have found the following practice quite as satisfactory as any I know of: All repaired triple valves are required to release when the pressure in the train line is increased through a hole in a diaphragm suitably arranged.

The size of the hole is determined in the following manner: Under a constant head of 90 pounds the train line should charge from 0 to 60 pounds in seven minutes. While this is not as close a test as is required of triples to pass the M. C. B. rules, where I am informed that the pressure under a constant head of 90 pounds will, feeding through a 3-32-inch hole, increase the pressure in a train line of fifty cars from 0 to 60 pounds in about ten minutes. The correctness of this last statement I am unable to vouch for. I have found that several of my acquaintances among air-brake men have found that considerable additional care was necessary in fitting the triple piston packing ring in order to pass even this test, which, it is hardly necessary to say, all new triples from either of the brake companies pass with ease.

In making the test I make a difference of 30 pounds between the main reservoir and auxiliary pressure. This causes the triple piston to travel the full limit into the part of the cylinder which is least worn in the case of an old valve. I have frequently found those which would release from the emergency position but would not release from the service position on account of the cylinder being worn. This would necessitate the dressing out of the unworn portion, or, better yet, the renewal of the bushing.

On our repair track we use a diaphragm which will allow the pressure under a head of 90 pounds to increase in the train line from 0 to 70 pounds in two minutes, and at present this gives our repairmen all the work that they can attend to. Any leak in the train line or connections after the diaphragm has been established, of course, draws the test proportionately finer.

If any of our friends have a better system I believe he would confer a favor on air-brake men generally by making it known. The only question in my mind is whether the above test is sufficiently fine for all practical purposes. It certainly has had the effect of lessening the number of sticking brakes and flat wheels under my observation.

G. S. HALE,
So. Pac Ry.
Oakland, Cal.

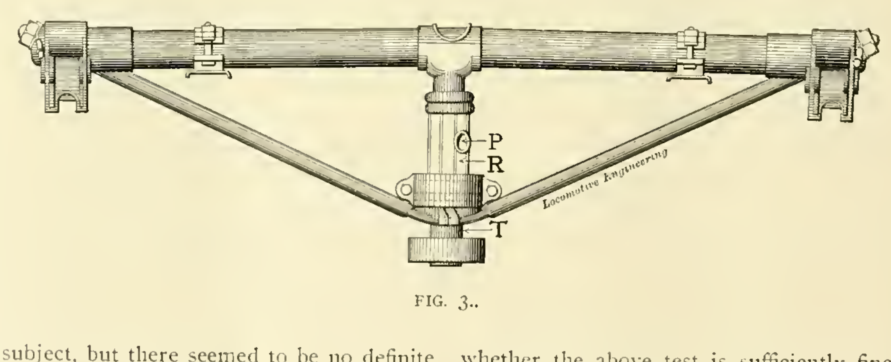
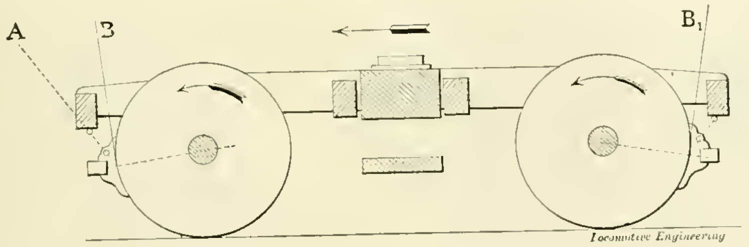


FIG. 3.

Object Lesson in Brake Beam Suspension.

Editor:

I would like to present to you some information coming to my notice, that a correct understanding of the matter of outside hung brakes on passenger cars may be obtained. I have read and reread the very valuable paper in the Air-Brake Association's 1898 Proceedings, by Mr. Parke, and clearly see (at least think so) the advantage of superior braking force by having inside hung brakes on passenger cars. But on account of peculiar truck construction, and perhaps an advantage of inspection and repairs on outside hung brakes, one would not jump in recommending a change to inside hung, where large expense is entailed.



BEAM SUSPENSION.

Recently I noticed some new cars where the suspension of the brake beams from the end-piece of the truck frame was like that indicated in the dotted lines A and A_1 in the accompanying cut, excepting the sides of the truck frame were shorter, and the hanger castings were therefore bolted to the outside of the end-pieces. Now, the question is: Would not a more desirable brake be obtained on this truck by having the suspension of the hanger (indicated by the solid lines B and B_1) come from the *inside* of the end truck piece, providing it could be done, than by having the brake beam hung from the *outside* of end piece? Mr. Parke very practically states that on many trucks now in use, it would, for constructive reasons, be impossible to properly incline a hanger.

I will state a bit of experience. A car, which was not braking satisfactorily, had a short hanger, bringing the center of the brake shoes but little below the horizontal center line of the axle. The angle or incline of the brake beam hanger was similar to the broken lines A and A_1 in the cut. The writer had the hangers lengthened and placed at an angle as shown in the solid lines B and B_1 in this cut. The result was a much better brake upon the car. J. B. BURTON.

Jersey City, N. J.

[In lengthening the hanger and reducing the angle you have practically demonstrated one of the principal points which Mr. Parke has established and proved. With the truck moving in the direction indicated by the arrows, and the hangers inclined as per dotted lines A and A_1, the forward brake shoe would furnish little retardation, and the near shoe would toggle upwards and probably slide that wheel. With the truck moving in the opposite direction, however, the action of the shoes would be the reverse of that just described. As will be observed, these shoe actions would be aggravated with short hangers as the shoes continued to wear. However, with hangers lengthened and placed as in solid lines B and B_1, you have caused the forward and rear shoes to brake about as nearly alike as is possible with the outside hung brake. Still, there is a difference. The only way to get exactly the same amount of work from each shoe is to use a properly designed and accurately calculated inside hung brake.—Ed.]

Good Main Reservoir Location—Semaphore Air Gage.

Editor:

Having noticed considerable in your columns regarding capacity and location of main reservoirs on freight engines, I thought probably it would be of some interest to say that on our small local freight and switch moguls we place a main reservoir 18 x 84 inches—20,500 cubic inches capacity, on the right side of the engine and directly under the cab. The air pump discharges into the front end, and the brake valve is connected to the back end.

On our large moguls, consolidated and culm burners, we place one, 18 x 84 inches, on each side under the cab, pumping into the first one and using air from the second one. This gives us about 41,000 cubic inches capacity on these engines, and we obtain clean, dry air, and have lots of it. All our freight engines are equipped with the latest model 9½-inch pump and F-6 (1892 model) brake valves.

In regard to the "semaphore" type of gage, I would say that we have between forty and fifty of them in use, and have had no trouble with them, with the exception of two, on which the train line hand had slipped, but after being firmly secured, these gave no further trouble. The enginemen like them very well, and we all think they are a decided improvement over the old duplex gage.

In connection with this I would like to endorse what Mr. Otto Best says about them on page 254, June issue, especially in regard to correct position of gage and the use of copper connecting pipes.

RAYMOND S. LEE,

Air Brake Repairman, N. Y. S. & W. R. R.

Stroudsburg, Pa.

A Good Metallic Packing for Air Pumps.

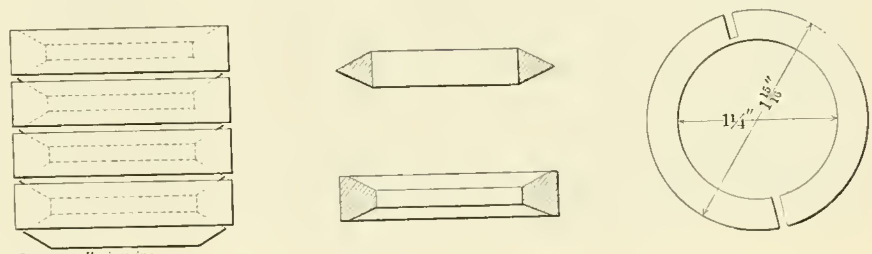
Editor:

I am sending you a set of metal packing for the 8-inch Westinghouse air pump, or enough for one steam and air cylinder of the New York duplex pump, believing it to be of enough interest to your readers to induce you to publish it for the benefit of those who may wish to use it. It is being used at a number of points on the Union Pacific Railroad, and of all the different kinds of metallic packing that I have seen tried, I know of none that gives as good service as this.

The same style packing can be used for the 9½-inch pump, and in fact I am using it successfully in air compressors and in stationary engines, when pistons are true; and when there is not too much play in guides, it works first class.

To apply it, break the pieces apart, and insert the convex piece first, then the concave, and so on, finishing with the concave. Two pieces of each can be used in a stuffing box, using a little asbestos saturated with valve oil and graphite or plumbago, to make a tight joint until the packing is set tight to the piston, when all that is necessary is to screw it up when it leaks. As it wears, new pieces can be inserted.

Laramie, Wyo. H. BREITENSTEIN.



METALLIC PACKING FOR AIR PUMP.

Once more—the fourth time—has the Westinghouse Air-Brake Company absorbed into its employ the president of the Air-Brake Association. This time it is Robert H. Blackall, who follows Burgess, Hutchins, Cass and Hedendahl. Mr. Blackall has been an active worker in the association's affairs, and his many friends wish him deserved success in his new position.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(100) R. J. L., Baltimore, Md., asks:

In overhauling the engineer's brake valve, am I doing right by oiling rotary valve and seat, in putting same together? If so, what is the best kind of oil to use? A.—It is proper to oil the parts. A mixture of beeswax, tallow, and possibly a little Paragon or Marvin grease, is a good lubricant for the rotary valve and its seat.

(101) P. J. R., Indianapolis, Ind., asks:

How much air is there held in the auxiliary reservoir of the standard 8-inch freight-car brake? A.—Professor Dudley computed the capacity of the standard freight auxiliary reservoir in the Karner tests at 1,620 cubic inches. Recently, however, more accurate measurement by other experts have made the figures 1,650, which is probably nearly or just about correct.

(102) V. H. B., Covington, Ky., asks:

What can an engineer do to soften the leather in the piston of the New York engineer's valve? A.—The better way to lubricate and soften the leather is to take it out of its cylinder in the brake valve similar to the packing in the brake cylinder. Sometimes the leather needs replacing instead of softening; however, the above recommended process will suffice and be better in either case.

(103) P. J. R., Indianapolis, Ind., asks:

How much air does the 1¼-inch train pipe, branch pipe and hose couplings of the ordinary freight car hold? The volume of the standard freight car train, as calculated by Mr. Dudley, engineer of tests of the New York Central Railroad, in the brake trials held at Karner, a few years ago, is 640 cubic inches. This multiplied by the pounds pressure gives the inch-pounds, or amount of air in the pipe.

INTERIOR VIEW OF INTERNATIONAL CORRESPONDENCE SCHOOLS' AIR-BRAKE INSTRUCTION CAR, NO. 105.

(104) A. B. J., Boston, Mass., writes:

When new packing rings are being turned up for a rebored air cylinder of the 9½-inch air pump, should the rings be turned up smaller than the cylinder, same size, or larger, before they are sawed or split? If larger or smaller, how much? A.—The packing rings for both the steam and air cylinders of the 6, 8 and 9½-inch air pumps should be turned up ⅛ inch larger than the bore of the cylinder before the rings are split.

(105) W. M. L., Chicago, Ill., writes:

I argue that an empty car gives more braking power than the same car does when loaded, on account of the load increasing the brake piston travel. Am I right? A.—Yes, unless the brake beams are suspended from the spring plank, or some other similar point, where the brake shoes do not drop down nearer the rail when the car is loaded. Cars so equipped do not vary their piston travel when car is loaded or unloaded.

(106) C. M. A., Bradford, Pa., writes:

Please settle an argument. Did, or did not, the first air-brake pump have leather packing or metal packing rings in the air cylinder? A.—The first air-brake pump was put on Pittsburgh, Cincinnati & St. Louis engine No. 23, in March, 1869, at Pittsburgh, Pa. It was made over from an old Worthington water pump and had leather packing in its air cylinder. The first real air-brake pump made, however, had cast-iron packing rings in the air cylinder.

(107) J. B. L., Kansas City, Mo., asks:

When and where was the first retaining valve used, and how did it operate? A.—In 1882, by Mr. H. C. Frazer, on the Denver & Rio Grande road. Mr. Frazer experimented there to find how the brakes on mountain grades could be made safer.

Complaint was found that the train would start too quickly when brakes were released to recharge auxiliary reservoirs. The outcome was the spring and diaphragm form of pressure retaining valve described in another question.

(108) W. M. L., Chicago, Ill., asks:

Why is a larger train pipe used in freight than in passenger service? A.—The increased pressure in a quick-action application must come from the train pipe, of course. It is figured, therefore, that a freight car length of 1¼-inch pipe will give, in an emergency application, 60 pounds brake cylinder pressure, an increase of about 10 pounds, or 20 per cent. over and above a service application, and that a passenger car length of 1-inch pipe will do the same for its brake.

(109) B. M. C., Springfield, Mass., asks:

What is meant by the "cross-over" hose, as mentioned by Mr. Sullivan on page 210 of May number? A.—The "cross-over" is a short length of air hose, about 8 or 10 inches long, with an air-brake coupling-head on one end and a signal-line coupling on the other. Should the train pipe of the air brake become disabled on a car, the signal pipe may be used as a train pipe on this car and brakes used to the rear of the train without switching cars. The brake on the disabled car, its signal and the signal on the cars behind are of course rendered inoperative thereby.

(110) J. B. L., Kansas City, Mo., asks:

Was not the first kind of retaining valve one with a spring arrangement inside, instead of the weight like is now used? A.—Yes. The first retaining valve used consisted of two brass disks held together by small screws. Inside was a copper diaphragm to which was fastened a small pin valve. On the other side was a spring having 10 pounds resistance. In the device was a cock, so arranged that when opened, the exhaust cylinder air passed freely to the atmosphere. When the cock was closed, the retaining valve was thrown into operation.

(111) J. F. K., Fond du Lac, Wis., writes:

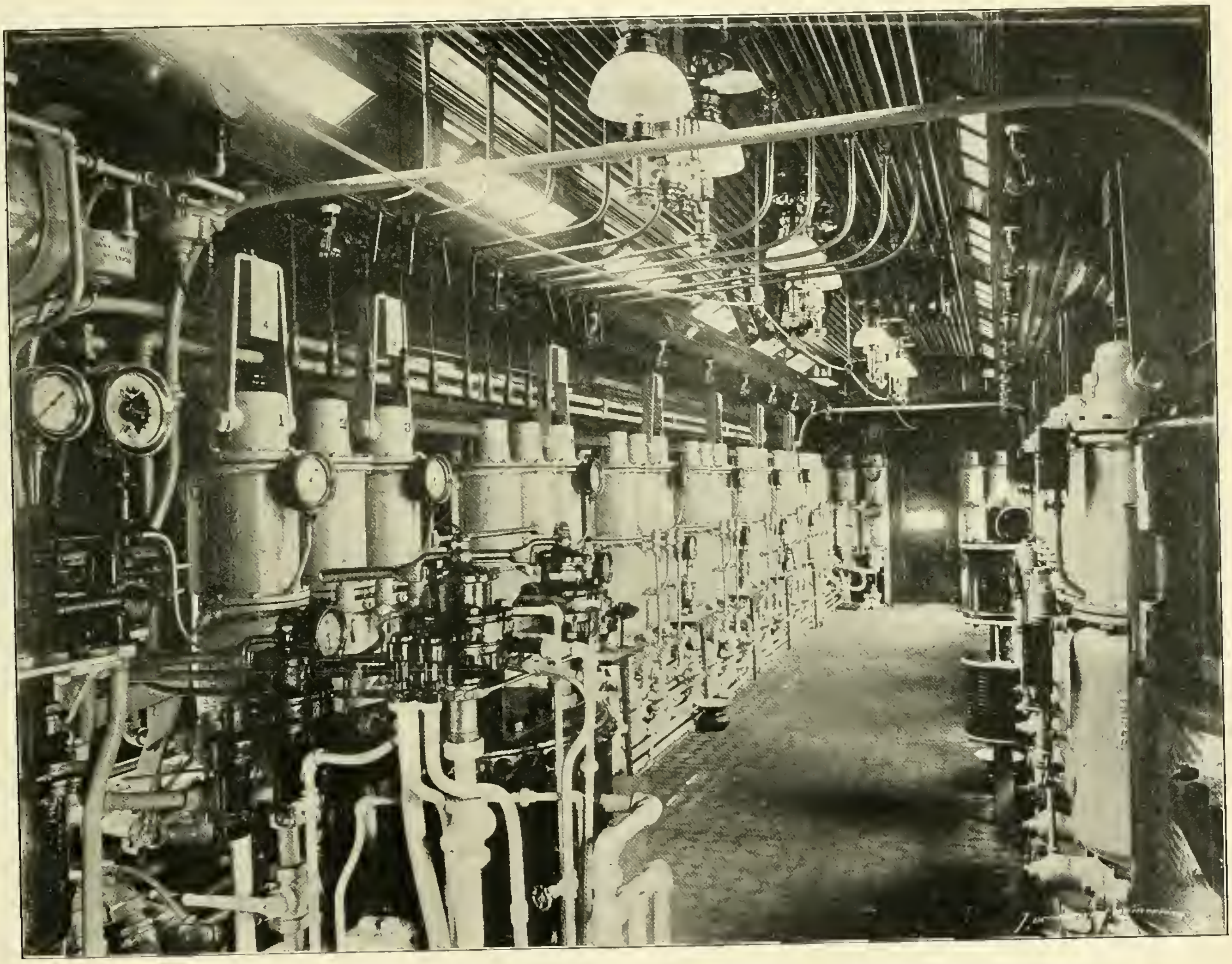
On the road that I am on, the first time the air pump gets hot and burns the rubber packing out, it is packed with shot. Is this a good packing for an air pump? A.—Shot packing was about the first kind of metallic packing used on air-pump piston rods, but is neither as good as the regular metallic packing nor Vulcabeston rubber packing. On a rod in reasonably good condition either of these packings will prove far more satisfactory than shot packing, especially if a well-oiled swab of candle wicking be kept on the rod.

(112) J. F. R., Fond du Lac., Wis., writes:

Nearly all of our air pumps that are packed with shot are groaning very badly. Is that on account of shot packing throwing the pump out of line? A.—Possibly, and especially if new shot is added to the old packing; but the most likely cause is that the packing blows and wastes air on the up stroke. When the shot is squashed down into a solid lead ring, the piston rod wears the hole larger, and screwing down the packing nut does not squeeze the hole smaller and the ring against the rod, like it will a softer and more yielding substance.

(113) A. B. J., Boston, Mass., writes:

How should the new packing rings be turned up and fitted into the air cylinder of a pump that is larger at the ends of the stroke and has not been bored out? I have overhauled a pump, except reboring the cylinder. The lift of the valves is all right, and it runs hotter than before being repaired. Cylinder is clean and piston well packed. A.—Rings should never be fitted



INTERIOR VIEW OF INTERNATIONAL CORRESPONDENCE SCHOOLS' AIR-BRAKE INSTRUCTION CAR, NO. 105.

into a worn cylinder until after it is rebored; for the rings can only be made to fit the smaller bore at the middle, and they will gap at the ends of the stroke, let the air churn from one side of the piston to the other, and cause the pump to run hot. Fitting new rings to a worn air cylinder is much like fitting a square peg into a round hole.

(114) G. E. L., Syracuse, N. Y., asks:

When the retaining valve is put on the needle beam under the car, and the train has to be stopped to throw the valves in and out of operation, is there not much time lost, and is there not also danger of train men being hurt crawling under the cars? A.—Of course, time is lost, but that can easily be made up, and is infinitesimal in comparison with the greater safety secured from tampering by reckless and ignorant train hands. The danger to train men is really serious, and, on the whole, should be sufficient to bring the retaining valve to its proper place up near the brake. Proper instruction and discipline would seem the better way to prevent train men from tampering with retaining valves on mountain grades.

(115) A. B. J., Boston, Mass., writes:

1. How much smaller is a new air piston head than the cylinder when it is new? A.—1. Both the steam and air piston heads of the 6, 8 and 9½-inch air pumps are turned up 1-64 inch smaller in diameter than the bore of the cylinder. 2. Will the old piston head be all right in a rebored cylinder or ought a new and larger piston head be used? A.—2. The old piston head will probably be all right for the rebored cylinder, unless the cylinder is very materially enlarged in truing up, or the head is badly worn. Some roads have found it cheaper and otherwise advantageous to scrap badly worn cylinders and replace them with new ones. Still other roads declare it less expensive to buy new cylinders than to attempt to rebore worn ones.

(116) B. A. U., Worcester, Mass., writes:

I observe on some Western cars going through here that the retaining valve is not on the end of the car up near the brake wheel, but instead is fastened on the needle beam under the car, and coupled up with less than 2 feet of pipe. Please say why this is done. One man says it is done to save pipe. A.—The purpose in locating the retaining valve on the needle beam was to put it out of the way of certain train men who, not satisfied with the way the engineer was dropping the train down a grade, would turn the handles down to let the speed increase. A serious runaway on a Western mountain resulted from this tampering, and all retaining valves were forthwith placed under the cars as described. This necessitated the stopping of the train at both the top and the foot of the grade to operate the valves.

(117) L. T. M., Cincinnati, O., writes:

I noticed an article in LOCOMOTIVE ENGINEERING stating that rack tests were made and that they could jump five cars on the head end, three in the middle and nine on the rear end of fifty cars. Is this due to the influence of train line volume? Why can nine cars be jumped on the rear end of fifty cars, when but five can be jumped on the head end? A.—This is due to the volume of air beyond the cut-out cars. If the forty-first to the forty-ninth cars, inclusive, be cut out and the fiftieth car left in, sufficient reduction can be made to pass through the nine cars and reduce the train pipe pressure on the one car sufficient to throw that triple in quick action. If the same number of brakes were cut out elsewhere in the train, and several left cut in just beyond, the reduction passing through the cut-out cars could not reduce the large volume in the several working cars sufficiently quick to produce quick action on those triples.

(118) W. H. D., Concord, N. H., writes:

A few years ago the writer had charge of equipping some engines with the air signal; also did light signal repairs. It was found where rust from moisture and non-use would accumulate on the signal valve the fit of the diaphragm stem in the bushing would be so snug the signal valve would not work all right, and to relieve the stem it was recommended to carefully use some fine emery cloth. Permit me to ask if there is any objection to using emery cloth, as cited above, on a snug-fitting diaphragm stem? I have never seen any. A.—Emery cloth is sometimes used for this purpose, and we believe that the manufacturer even uses it; but its tendency to burrow into the metal and stay there has long been believed by many mechanics, who therefore use sandpaper instead. Possibly the light use and thorough cleaning off afterwards would not render its use detrimental in the above described case.

(119) D. D. M., Dennison, O., writes:

Referring to your "Calculations of Brake Cylinder Pressures" in June number, I have made a series of tests and my results differ from those figured from your "approximate" formula. Kindly give more accurate formula that I may figure my data to your method. A.—As stated at the time the formula was given, there are five most difficult and perhaps immeasurable controlling conditions which must be taken into consideration, viz.: loss of pressure due to work done by pushing brake piston out, loss of pressure due to cooling in expanding, loss through leakage groove, increased volume when triple moves, and clearance in brake cylinder. Add to these the friction of the triple, inaccuracy of triple-valve movements, and you will have a lot of variable and immeasurable quantities that will make the formula only approximate, as stated when it was given. You might add a constant for immeasurables to the necessary side of your equation, and thereby figure your data to the formula. Try it.

(120) W. P. Alter, Dennison, Ohio, writes:

Referring to article "Will the Gage Tell?" in February number, 1900, you explain the action of triple having a broken graduating pin. Of course, we cannot get an application through the graduating port on account of the graduating valve being held in its seat by the auxiliary reservoir pressure. Do you mean that this application will be had through port S of the slide valve? Surely not. Is not the quick acting port next to be exposed to auxiliary pressure after service port is closed? And again, will not quick action port be exposed after the graduating stem has been partly compressed and port S not opened until the triple piston has nearly completed its full travel and graduating spring been compressed? A.—The first port opened in the above case will be the quick action port. If the port is uncovered very slowly, auxiliary reservoir pressure may pass around the loose-fitting emergency piston to the brake cylinder, instead of shoving the piston down into quick action. Of course, the opening must be exceedingly slow, yet it is possible. Port S does not open until considerably after the emergency port.

(121) F. L. H., Sioux City, Ia., writes:

Please settle an argument. Why is it that on an 8-inch pump you will almost always find the lower discharge broken, and on the 9½-inch pump it is nearly always the upper discharge valve. I claim that on an 8-inch pump the stroke is down to compress the air and up on the 9½-inch pump, and for that reason the dirt and oil are so near the valves and they are more apt to break. Am I right? A.—No. The lower discharge valve in the 8-inch pump is not always the first to break. True, it gets more oil and dirt, and is therefore more likely to break first; but too much lift and bad valves facilitate breakage more than dirt and oil. The difficulty to correctly measure the lift of the upper discharge valve of the 8-inch pump often results in it going in with too little lift; hence, the less likelihood of its breaking. Nor does the upper discharge valve in the 9½-inch pump break oftener, as a general rule, than the lower. The lift of the valves in this pump is easier to get right, and should therefore give less trouble from that source. The lower discharge valve opens on the down stroke and the upper discharge valve on the up stroke, with both the 8 and 9½-inch pumps, and dirt and oil should therefore gravitate to the lower discharge valve in both cases. Possibly your 8-inch pumps are oiled through the lower suction valve, and the 9½-inch pumps through the oil cup on top of air cylinder. In this event, should a great deal of oil be used, the tendency for the valves to break, other things being equal, would be as you describe.

(122) W. R. B., Bessemer, Ala., writes: I had a train of sixteen air cars, which were tested at the terminal and worked all right. I had occasion to stop 12 miles from town for orders. After I stopped I left my brake valve handle in full release, and after I started my brakes would stick and release for about 15 miles. When I stopped and made an emergency application, and after I got train pumped up, I did not have any more trouble with my brakes. What was the cause of the brakes sticking, and what is the best remedy? A.—The trouble was doubtless caused by the brake valve handle being left in full release position after the stop had been made and brakes released. In this position main reservoir pressure was permitted to flow unrestricted through the release position ports to the train pipe, where higher pressure was accumulated than the feed valve attachment was adjusted for, thus overcharging the train pipe. Then when the brake valve handle was returned to running position, the overcharge in the train pipe had to leak down to 70 pounds, or whatever the feed valve attachment was set for, before main reservoir pressure could again enter the train pipe. In the meantime brakes would set, due to train pipe leakage. Moving the handle to release position would knock the brakes off. The emergency application was no relief from your trouble, except that it reduced your overcharged train pipe. A service application would have done equally well. This trouble may be avoided by leaving the handle in release position long enough only to release the brakes, then bring it to running position to recharge. This applies only to level road work.

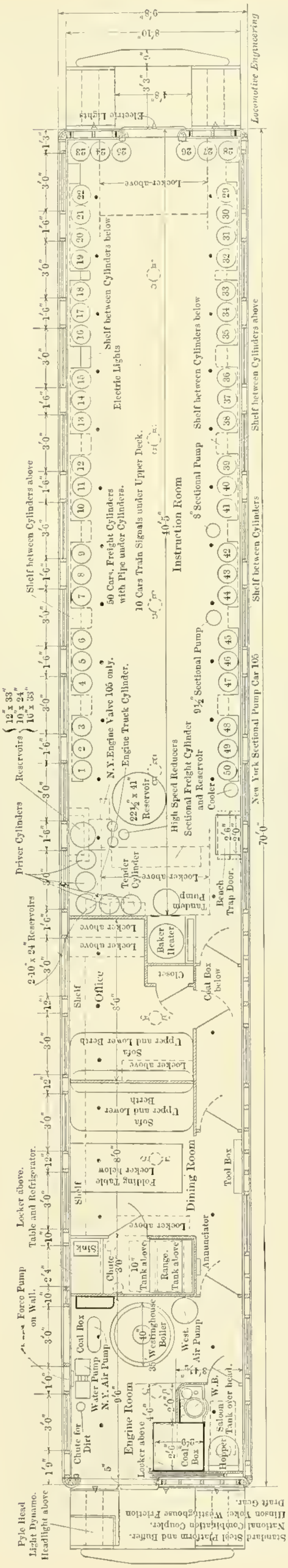
Interstate Commerce Commission Report.

The advance copy of this report is out, and from it many interesting details of railroad operation and equipment may be learned. Statistics are usually so extended and dry that we have selected only a few of the most interesting to our readers.

The data contained in the summaries of railroad operations and expenses are classified in ten territorial groups. The New England States form group No. 1; New York, Pennsylvania, New Jersey, Delaware and Maryland, group No. 2, and so on. The lines marking the limits of the groups are not in each case the same as the State lines, but follow the lines of railroad territories, as, for instance, Ohio, Indiana, part of Pennsylvania and the lower peninsula of Michigan form group 3.

In track mileage there is shown a total of 252,369.48, an increase of 4,831.96; of this 1,645.91 miles is yard track and sidings, which is a measure of the better terminal and station facilities.

Group 2—New York, Pennsylvania, New Jersey, etc.—shows the greatest proportion of double track to single track, there being 21,114,27 miles of single track, 5,684.32 of double track, and 1,443.58 of third and fourth tracks, with 10,300.94 of yard tracks and sidings. This proportion of yard tracks is approached only by group 6, which takes in Illinois, Wisconsin, Minnesota, Iowa and parts of the adjoining States, in which the proportion is 42,866.56 miles of single track, 2,091.97 second track and 10,535.06 yard track and sidings.



PLAN OF INSTRUCTION CAR 105—INTERNATIONAL CORRESPONDENCE SCHOOLS.

There were in service June, 1899, 36,703 locomotives, an increase of 469 as compared with the preceding year. The report does not give any figures of the relative increase in the hauling power of the locomotives. If this could be shown, it would give evidence that small locomotives are being replaced with much more powerful ones, so that a very substantial increase of tonnage can be handled by the same number of engines.

The report goes into the statistics of automatic couplers very extensively, showing each kind and in what group of States used. There are just an even hundred kinds of automatic couplers mentioned; five are varieties of the Miller, the rest we conclude are of the Master Car Builders' type. As all cars now in service are equipped, we do not need to give any figures.

Nowhere in the report does it state just what proportion of the cars in a train should be equipped with train brakes in order to comply with the provision of the law, "that a sufficient number of cars should be so equipped that the engineer on a locomotive drawing a train can control the train without requiring brakemen to use the common hand brake for that purpose."

Of locomotives, only about 2,000 of the 36,703 in service were not equipped with train brakes; a fair share of them were likely switch engines. The cars so equipped numbered 773,446, over 56 per cent. Since June, 1899, a large number of new cars have been built equipped with train brakes, and there is no doubt that over 75 per cent. are now ready for service. If they are kept in working order, trains can be easily controlled without the use of hand brakes from this date.

The report shows a relative as well as an absolute increase in the number of accidents for the year ending June 30, 1899, which is charged to a greater density of traffic and employés per mile of track operated; liability to accident is in proportion to the number of men and trains per each mile operated.

It is shown that the larger proportion of accidents is among trainmen, more than 50 per cent. Coupling and uncoupling cars caused the greatest number; falling from engines and trains is next on the list.

It strikes one as a little singular at first to see cars stenciled "To be used only for horses or milk," but it's all right when you think it over.

Fast Heavy Passenger Service on the Central Railroad of New Jersey.

The busy New Yorker who must remain in the city during the heated summer season seeks a cool place by the seashore where he may be comfortable after the business hours of the day in the sweltering metropolis are over. Naturally, he turns to some nearby place, where he may go to and from his business with as little loss of time as possible. The beaches and summer resorts on Long Island and the New Jersey shore offer him the better inducements; for fast express trains to these places have been arranged especially for him. He is whirled in and out of the city with the least possible loss of time by rival railroads and transportation companies.

Through the kindness of Mr. W. McIntosh, superintendent of motive power of the Central Railroad of New Jersey, we were permitted to ride on the engine hauling one of these fast express trains between Asbury Park and Jersey City.

Promptly at 7.30 A. M. Engineer Ross, holding in his hand our locomotive permit, pulled out of Asbury Park with Brooks engine No. 494, which was especially designed by Mr. McIntosh for fast-freight traffic and heavy passenger travel during the seashore season. The 20 x 28-inch cylinders filled with steam from the huge boiler, whose pressure was 210 pounds, the 69-inch driving wheels ground into the rail, and the massive locomotive of 175,000 pounds, tender and train of heavy parlor cars and coaches moved out of the station. White flags in the hands of street watchmen signalled the train forward. Steam was used right into North Asbury, the shut-off and brake application being simultaneous, for there is no time to be lost on this run.

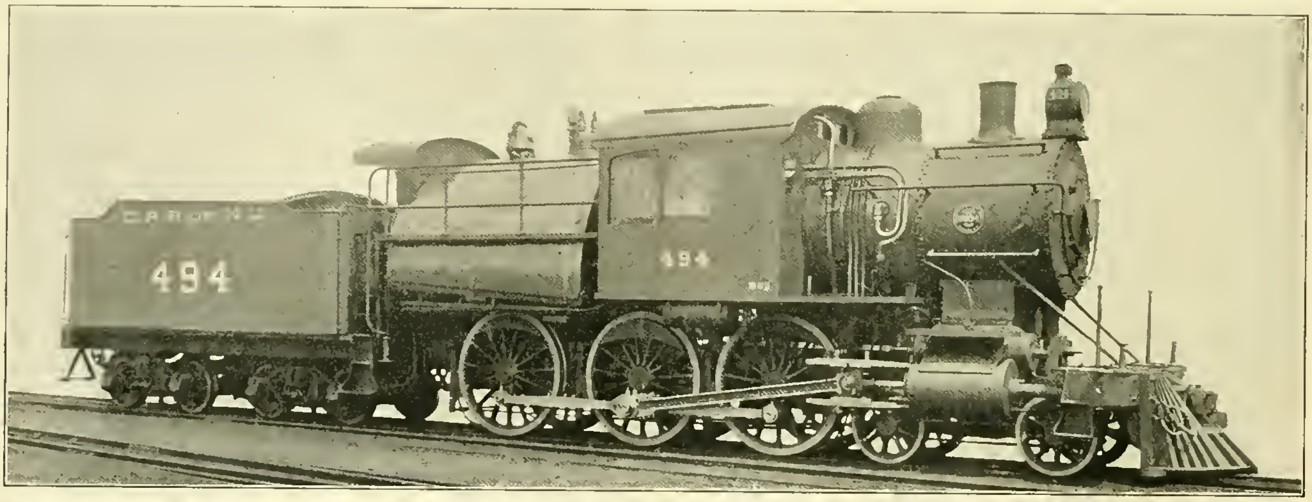
Fifteen seconds sufficed to embark the passengers at North Asbury, four at Allenhurst, seventeen at Deal Beach, fourteen at Elberon, twenty at Hollywood, and forty-two at Long Branch. These remarkably short stops evidence the education of the seashore travelers. Last partings have been made and goodbyes said before the train stops. Nothing then remains but the embarking, and the New Yorker is quickly in his seat, absorbed in his morning paper and oblivious of material things until the swift train glides into the Jersey City station.

Not so the reporter on the engine, whose detail it is to describe the passage of the mammoth metal machine and its brightly varnished train of human freight. He observes the fierce "chomp! chomp! chomp!" of the exhaust steam as the engine gets under way and gradually increases speed. The white flags in the hands of the street-crossing watchmen wave a forward signal. This line of flags up the track reminds one of a skirmish line in war time. There is no pound in the engine as she picks up her train. She is as solid as one of New York's skyscraper buildings on its rock foundation. Once she slips as she is urged forward, and the quickening "chomp! chomp! chomp!" is turned into almost a deafening peal of thunder by the high-pressure steam pouring from the short, keg-like smokestack close to our ear. She quickly settles down, however, and tugs and strains like a hound at the leash. She wrenches and writhes as she pulls the speed up to sixty miles per hour. The white flags and red semaphores seem everywhere. There is no separate and distinct exhaust sound now at the stubby smokestack—a roar like the tremendous whirring of a thousand gigantic wings has taken its place. Only when we come to the up grades of the rolling country do the distinct exhausts become apparent. Then on the downward pitch she again increases to the sullen roar.

At Red Bank steam is shut off, and the train drifts through the town and past the white flags and semaphores. Then Ross gives her steam and widens on the throttle. She belches forth from her stack an angry, thunderlike peal as she takes the trestle with a loud hum. The mammoth machine plunges forward with her heavy train, and is soon up to speed again. She throws off miles in as easy fashion as the conductor punches his tickets in the cars behind. The last mile went by in fifty-eight seconds, and as though proving that she still has power in reserve, she reels this one off in fifty-seven, which is a very creditable achievement for a freight engine just out of slow service. She takes the curves with a long, easy roll, like a ship takes a wave. We write as she rolls, and this speaks well for the condition of engine and track. We plunge under a low overhead bridge, and the short stack emits a quick explosive sound as we pass.

Gazing with squinting eyes through the cab window which Fireman Ferguson is too busy to enjoy, we cannot but observe the beautiful coloring of the landscape as we go skimming through. The green foliage of the woods, and ripening corn and vegetables of the fields, the freshly painted and multi-colored houses along the route, the turquoise blue of the morning skies and the green waters of the sea, with its white-winged sailboats, form a beautiful painted picture not nearly so vivid to the passengers in the cars behind.

The smoke of Jersey City and the dome of the ferry house tell us that the run is almost finished. There is but little more left. The switch frogs and guard rails clatter, and the air brake hisses as we weave in and out through sinuous windings of track and finally glide into the train shed on time, despite delays caused by slow orders and drawbridges. The panting engine seems to speak in eulogy of her designer and to voice her achievement as a practical demonstration of her ability to work equally well in fast freight and heavy fast passenger service. N.



HEAVY EXPRESS ENGINE ON CENTRAL RAILROAD OF NEW JERSEY.

Our friend, Charles Longstreth, of the United States Metallic Packing Company, has been trying to escape the heat by exercising his 65-foot yacht, "Ted." He made the run from Philadelphia to Atlantic City, via Cape May, 150 miles, in about 15 hours.

Personal Department.

Mr. Wm. M. Bacon has been appointed trainmaster of the Colorado & Southern at Trinidad, Colo.

Mr. S. M. Maxwell has been appointed trainmaster of the Indiana, Decatur & Western at Moorefield, Ind.

Mr. Herbert T. Herr has been appointed master mechanic of the Kansas division of the Chicago Great Western.

Mr. J. H. McGill has been appointed master mechanic of the Chattanooga Southern at Chattanooga, Tenn.

Mr. W. G. Tait has been appointed purchasing agent of the Wisconsin & Michigan, with headquarters at Chicago, Ill.

Mr. Owen M. McCarthy has been appointed trainmaster on the Pennsylvania at Renovo, succeeding Mr. E. D. Gardner.

Mr. J. C. Vining has been appointed trainmaster of the Colorado Midland at Colorado Springs, Col., in place of Mr. S. S. Morris, resigned.

Mr. K. P. Alexander, foreman of the St. Louis & San Francisco at Newburg, Mo., has been promoted to division foreman at Ft. Smith, Ark.

Mr. P. J. Langan has been appointed superintendent of air brakes for the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa.

Mr. A. R. Dillon has been appointed purchasing agent of the Kansas City Southern, succeeding Mr. Ira C. Hubbell; office at Kansas City, Mo.

Mr. E. T. Campbell has been appointed purchasing agent of the Minneapolis & St. Louis at Minneapolis, Minn., succeeding Mr. S. M. Lohren, resigned.

Mr. H. A. Fritz, mechanical engineer of the Illinois Central, has resigned to accept a position with the Cooke Locomotive Works, Paterson, N. J.

Mr. N. E. Sprowl has been appointed master mechanic of the Columbia division of the Southern at Columbia, S. C., succeeding Mr. T. S. Inge, resigned.

Mr. T. E. Clarke has been appointed superintendent of the Scranton division of the Delaware, Lackawanna & Western, vice Mr. A. C. Salisbury, resigned.

Mr. A. C. Adams, roundhouse foreman of the Chicago, Rock Island & Pacific at Trenton, Mo., has been transferred to Goodland, Kan., as general foreman.

Mr. Frank Cizek has been appointed assistant trainmaster of the Morris & Essex division of the Delaware, Lackawanna & Western at Hoboken, N. J.

Mr. J. E. Burke has been appointed division master mechanic of the Atchison, Topeka & Santa Fé, succeeding Mr J. E. Gavitt; headquarters at Newton, Kan.

Mr. W. Denison has been appointed general foreman of the Missouri, Kansas & Texas, succeeding Mr. A. D. Arbegast, resigned; headquarters at Denison, Texas.

Mr. M. K. Jones has been appointed assistant superintendent of the Cascade division of the Great Northern at Everett, Wash., succeeding Mr. W. D. Scott, promoted.

Mr. O. M. Crane has been promoted from passenger engineer on the Cincinnati, New Orleans & Texas Pacific to trainmaster, succeeding Mr. S. F. Randel, resigned.

Mr. John L. Mohun, master mechanic of the Pennsylvania at Lambertville, N. J., has been promoted to the position of assistant engineer of motive power at Jersey City, N. J.

Mr. Daniel H. Deeter has been appointed master mechanic of the Philadelphia & Reading, succeeding Mr. H. Delaney, resigned; headquarters at Philadelphia, Pa.

Mr. F. T. Slayton has been appointed master mechanic of the St. Joseph & Grand Island and Kansas City & Omaha at St. Joseph, Mo., vice Mr. A. C. Hinckley, resigned.

Mr. W. G. Besler has been appointed superintendent of the Lebanon division, in addition to his duties as superintendent of the Reading division of the Philadelphia & Reading.

Mr. A. E. Tremp, master mechanic of the Ohio Southern, has resigned and accepted a similar position with the Toledo, St. Louis & Western at Frankfort, Ind., vice Mr. C. Skinner.

Mr. H. Delaney, master mechanic of the Philadelphia & Reading at Philadelphia, has resigned to accept the position of locomotive superintendent of San Francisco Railway at Alagoihas, Brazil.

Mr. W. D. Scott, assistant superintendent of the Cascade division of the Great Northern, has been appointed superintendent of the Montana division, vice Mr. W. T. Tyler, resigned; headquarters at Havre, Mont.

Mr. W. D. Lee, general superintendent of the Rio Grande Southern, has been appointed superintendent of the Second and Third divisions of the Denver & Rio Grande at Salida, Colo., vice Mr. R. M. Ridgway.

Mr. Alexander Kearney has been appointed superintendent of motive power of the Philadelphia, Wilmington & Baltimore at Philadelphia. He was formerly assistant engineer, motive-power department, Pennsylvania Railroad.

Mr. W. G. Pearce, assistant general superintendent of the Northern Pacific and general manager of the Seattle & International, has been promoted to assistant to the president of the Northern Pacific at Tacoma, Wash.

Mr. J. R. Groves has been appointed superintendent of machinery of the Colorado Midland at Colorado City, Colo., succeeding Mr. A. L. Humphrey, resigned. Mr. Groves was formerly superintendent of machinery of the St. Louis & San Francisco.

Mr. Richard D. Gallagher, Jr., has been appointed mechanical engineer of the Standard Coupler Company, New York. Mr. Gallagher has been for some time connected with the car department of the Grand Trunk Railway at Montreal, and was formerly with Pullman's Palace Car Company, at Pullman.

On account of the death of L. D. Richardson, which occurred at Hot Springs, Ark., August 4, 1900, the office of general superintendent of the Hot Springs Railroad has become vacant. The duties of that position will be assumed by Jay Morton, president, in addition to present duties, with additional office at Hot Springs, Ark.

Southern Pacific's President Dead.

Collis P. Huntington, president of the Southern Pacific Railroad, is dead. He died of apoplexy in his Adirondack camp, August 16th. Ten minutes before his death he was apparently in robust, vigorous health. While a man well advanced in years, and his death not entirely unexpected, still his sudden demise is a great shock to the railroad world, and especially to those in railroad work under him. Mr. Huntington was always true to his business associates and very popular with his employés.

A brief outline of his career will illustrate why he was popular. Born of poor New England farmer parents, he was early put to work, and at the age of fourteen set out to shift for himself. He began as a peddler of clocks, and gradually expanded into a small country merchant. The discovery of gold in California attracted him thither—not as a miner, however, but as a well-to-do merchant; for his shrewd commercial instinct apprised him of the greater commercial advantages of trade in a growing country.

Here he became associated with Stanford, Hopkins and Crocker, who joined him in the building of the Central Pacific Railroad. This gigantic achievement placed him at the head of railroad financiers and gained for him an unlimited credit. Only once in his career was he embarrassed financially, and that was in the panic of 1893, when he found himself short of ready cash. New York's greatest bankers, however, realizing what the fall of such a financial giant would mean, promptly came to his assistance and pulled him through.

After conquering the West, Mr. Huntington came East, built up the Chesapeake & Ohio Railroad and put it on a paying basis after a number of his predecessors had been ruined in the attempt. He founded the city of Newport News, building it up from a town of five houses, and erecting there one of the greatest shipyards in the country. He was the head and director of numerous other transportation and associated interests, all of which were eminently successful.

His busy, aggressive career is the life story of the poor, farmer boy, born in poverty, but self-lifted by his own genius and indomitable perseverance to the very pinnacle of fame and affluence.

The report of the proceedings of the seventh annual convention of the Air-Brake Association, held in Jacksonville, Fla., last April, seems to be thoroughly appreciated, judging from the rapid sale. This is undoubtedly one of the best books the Association has yet put forth, and no air-brake library will be up to date without it.

The St. Louis office of the Bethlehem Steel Company has been discontinued, and the territory hitherto covered by it will be handled direct from the Chicago office.

A New Injector.

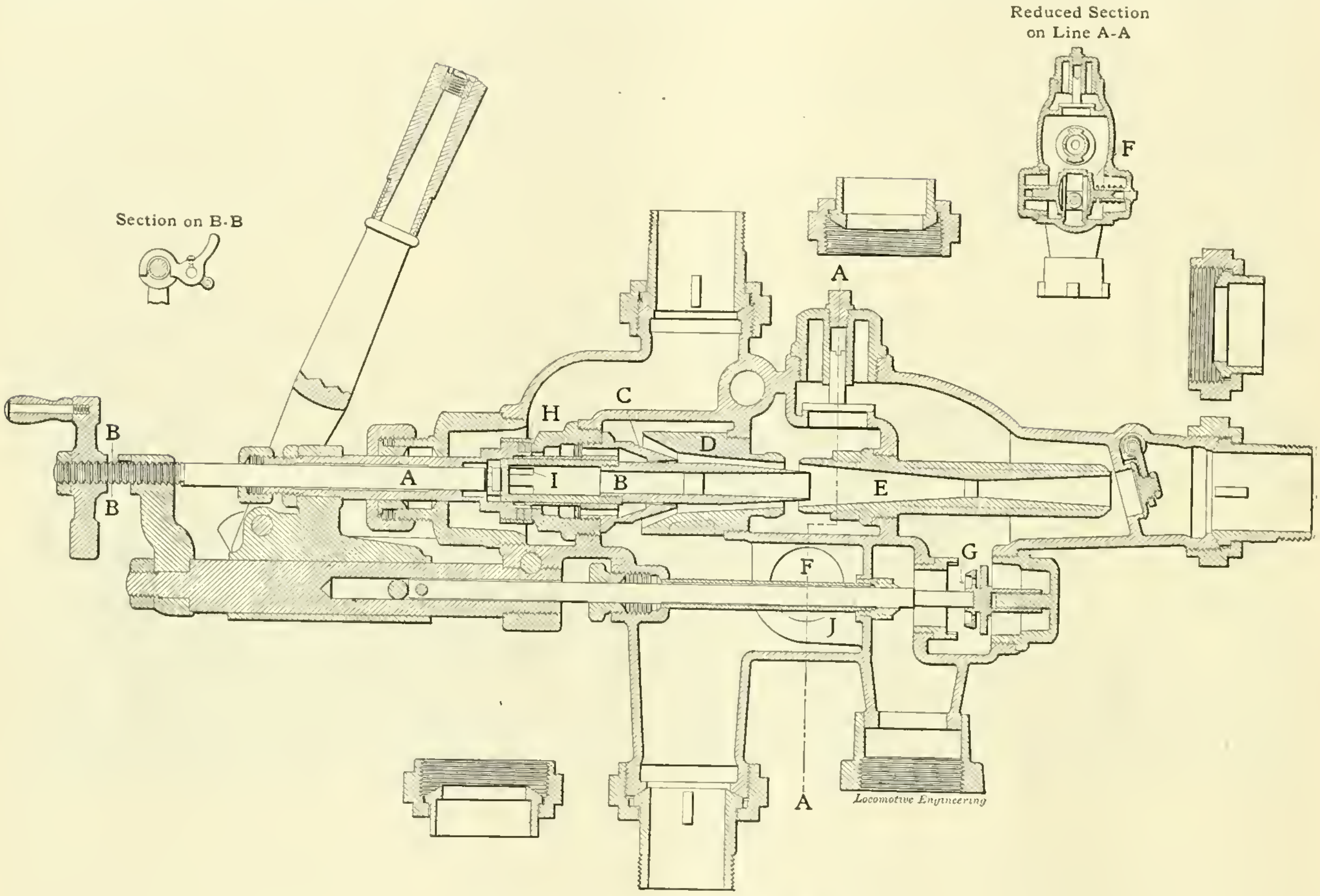
The Lunkenheimer Company, Cincinnati, have brought out a new injector which has several new points and represents the latest inventions of their Mr. Desmond.

Pulling the lever slightly opens the steam valve *H* and admits steam to the lifting jet *C* through an annular space around *B*. Steam flowing into tube *D* forms a vacuum in water-supply pipe and "lifts" the water, which goes out overflow. Drawing handle farther back opens the ports *I I* in steam tube *B*, forces water through combing tube *E*, past swinging check to boiler.

A special feature is made of the auxiliary water valve *F* (in both the main view and the cross section), and, as will be seen, it allows an additional supply of water to be drawn in by the column of water passing into combing tube *E*. As shown in the cross-section, this can be put on either side of injector, the changing of cap and valve making it either right or left handed. It will also be noticed that all the valves can be ground in readily. After removing cap to put any abrasive desired on the valve, the cap is replaced, minus the plug in center, and ground in with a screw-driver. The steam is thus guided so that a good joint is readily obtained.

The final overflow *G* is held open by the rod *J*, which is controlled by operating handle and closed by currents of water as soon as rod *J* is moved back. This valve disk is of peculiar construction and is self-cleaning, dirt or scale being prevented from lodging by the action of the water down the groove and through the holes shown.

The heater stop is shown separately, near the handle. This is normally left in position shown, but when wishing to use the injector as a heater, this is lifted and the handle screwed clear in. Then the lever is drawn back; but very little steam is admitted to suction. This can be increased by turning handle. This handle also regulates water supply by moving the coned tube *B* in or out of the nozzle *D* and regulates the steam pressure to correspond. They issue a direction book of this injector, which gives further details.



SECTIONAL VIEW OF LUNKENHEIMER INJECTOR.

Tests have shown that with steam at 120 pounds, feed at 65 degrees Fahr., and 18 inches lift, the weight of water forced into boiler per pound of steam varies from 9.69 pounds for lowest to 13.80 pounds for highest. A fair average of six of the best instruments is nearly 13 pounds of water per pound of steam. With a locomotive evaporating 3,000 gallons of water per hour, as many do, this means 230 pounds of steam to work injector. Allowing 30 pounds of water per horse-power hour, it requires nearly a horse-power to feed the boiler alone.

Ten-Wheel Passenger Engine for Chicago, Rock Island & Pacific.

We show with this one of a lot of sixteen ten-wheel compound engines recently built by the Baldwin Locomotive Works for the Chicago, Rock Island & Pacific road. Fourteen of these were for freight service, and the remainder for passenger work—one of the latter being shown. The only difference is in the diameters of both drivers and truck wheels. The general dimensions follow:

Cylinders:
- Diameter—High pressure, 15½ inches; low pressure, 26 inches.
- Stroke—28 inches.

Boiler:
- Diameter—66 inches.
- Thickness of sheets—11-16 and ¾ inch.
- Working pressure—200 pounds.

Firebox:
- Material—Steel.
- Length—118 inches.
- Width—40⅛ inches.
- Depth—Front, 79½ inches; back, 67 inches.

Tubes:
- Number—329.
- Diameter—2 inches.
- Length—15 feet.

Heating Surface:
- Firebox—180.5 feet.
- Tubes—2,569.6 feet.
- Total—2,750.1 feet.
- Grate area—32.8 feet.

Driving Wheels:
- Diameter outside—Passenger, 78½ inches; freight, 64¾ inches.
- Diameter of center—Passenger, 72 inches; freight, 57¾ inches.
- Journals—9 x 12 inches.

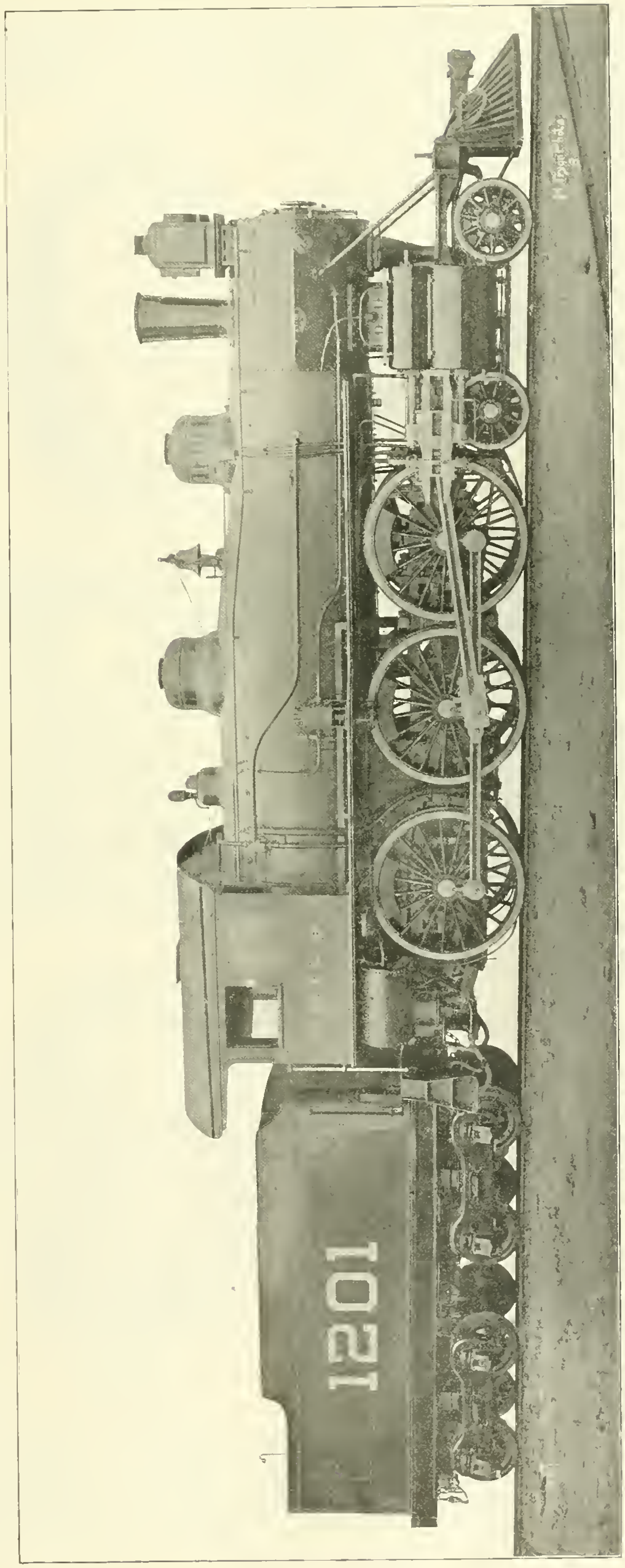
Engine Truck Wheels:
- Diameter—Passenger, 36 inches; freight, 30 inches.
- Journals—6½ x 11 inches.

Wheel-base:
- Driving—14 feet 6 inches.
- Rigid—14 feet 6 inches.
- Total, engine—26 feet 9 inches.
- Total, engine and tender—53 feet 6⅝ inches.

Weight:
- On drivers—Passenger, 134,560 pounds; freight, 130,150 pounds.
- On truck—Passenger, 44,715 pounds; freight, 42,865 pounds.
- Total, engine—Passenger, 179,275 pounds; freight, 173,015 pounds.

Tender:
- Diameter of wheels—Passenger, 36 inches; freight, 33 inches.
- Journals—5 x 9 inches.
- Tank capacity—5,500 gallons.

The "Sherburne" sander, heretofore handled by the Automatic Track Sander Company, of Boston, is now handled by the American Locomotive Sander Company, of Philadelphia. Therefore all inquiries regarding the Sherburne sander should be addressed to them at 427 North Thirteenth street, Philadelphia.



BALDWIN TEN-WHEELER FOR CHICAGO, ROCK ISLAND & PACIFIC RAILWAY.

OFFICERS OF THE TRAVELING ENGINEERS' ASSOCIATION.

Atchison's Recent Purchases.

Considerable public criticism has been made by the financial papers lately of the expenditures made by the Atchison management in acquiring additional railroad property. A director of the company gives an explanation of the reasons for the purchase of three short roads as follows:

"The three properties bought represent a very small percentage of our total mileage, and each purchase is destined to add to the earning capacity of the system. The San Joaquin Valley road is already earning its fixed charges, and it will give us an independent entrance into San Francisco. The Hutchinson & Southern is now paying its way, and it will give the Atchison a large amount of business in addition. It is an outlet of the Oklahoma region, which has a very large crop of wheat this year. The Gulf, Beaumont & Kansas City Railroad was taken for the sake of the rich timber lands. Possession of this road assures us of a supply of ties for many years to come."

Long Island and Proposed East River Bridge.

The removal of the financial department of the Long Island Railroad to the Pennsylvania Railroad headquarters at Philadelphia seems to indicate to railroad men that the New York Central will not share with the Pennsylvania in the control of the Long Island property. The Central interests will dominate the new East River bridge, which is to be built, and it is suggested that Mr. Vanderbilt is therefore willing that the Pennsylvania shall enjoy full proprietorship of the Long Island road, which will be more or less dependent on the proposed bridge for a traffic outlet.

We have been favored with a copy of the *Journal of Industry and Trade*, which is being published by the M. S. Frède Company, of New York, to further Russo-American trade relations. We take their word that it's interesting, as we can't prove to the contrary. It's printed in Russian.

Storing Coal.

It is not unusual for railroads to have a large stock of soft coal stored to use in case of blockades, strikes at the mines, and similar causes which may cut off the supply for a time, while the roads which depend on lake transportation for their supply are forced to store coal. Most of this coal is stored in large piles in the open air, where the rains and sun can hurry up the work of slacking and disintegration which robs it of heating power.

Occasionally we see it stored in covered bins or under the protection of coal chutes, and the question comes up, What is the difference in loss between coal stored in covered bins and that piled up in the open air, exposed to the elements? Who knows just what this percentage of loss is?

Navigation on the Dead Sea.

The Dead Sea, on whose waters no rudder has been seen for centuries, is to have a steamboat line. The promoters of the enterprise are the inmates of a Greek cloister in Jerusalem, and the management of the line will be entirely in German hands. The increasing trade of the desert and the influx of tourists require a shorter route than the old one between Jerusalem and Kerak, the ancient capital of the land of Moab. The first steamer, built at the Hamburg docks, is 100 feet long and has already begun the trip to Palestine. Another is building, which, like its mate, will carry about thirty-five passengers and freight of all kinds.

The Seaboard Air Line have awarded to the South Baltimore Car Works a contract to build within the next six months 2,000 freight cars. The specifications provide for 1,000 flat cars, 700 box cars and 300 refrigerator or ventilated fruit cars. Among the special equipment are Pressed Steel Car Company's trucks and bolsters, adopted through the efforts of T. N. Motley & Co.; side bearings provided by the Chicago Equipment Company, and Standard couplers.

Prohibitionist Stumping Train.

The Prohibitionists of New York held a meeting recently and decided to make a thorough canvass of the United States during the coming campaign. "To do this," says the New York *Sun*, "they are going to charter a special train, which will travel from ocean to ocean during October. The train will be decorated with the national colors and it will leave Chicago east over the Northern route about October 1st. John J. Woolley, the nominee for President, and Mr. Metcalf will be aboard the train all the time, and as it passes from State to State the nominees for local offices will be taken up. It will come from Chicago to this city, where five or six meetings will be held. Then it will start West over a Southern route and go through to San Francisco. From San Francisco it will return to Chicago over a Northern route. The Silver Lake quartet will be aboard all the time and will sing prohibition songs. The train will stop at every town in which a guarantee fund of $100 is raised. The Prohibitionists have no doubt that a great deal of good will be done for their cause by this method of campaigning."

A recent issue of the New York *Sun* contained one of the best satires that we have seen on the alleged railroad story of the day. It was called "Orville Mason's Last Express," and tells how a thirteen-year-old boy ran a train without a director's permit. The author, Charles Battell Loomis, deserves the commendation of railroad men for showing this up in such a ludicrous light.

Steel Steam Chests.

On some of their older type of engines, where the location of the steam chest studs will not allow of a thicker wall being used in the steam chest, cast-steel steam chests are being used by the Delaware, Lackawanna & Western Railroad. It is more trouble to do the machine work on these steam chests, but they do not break at any pressure so far put in them. Steel castings for new engines are plenty, but this departure of steel castings to replace iron on old engines is a move in the right way.

Train Rate War Threatened.

A rate war is threatened between the grain-carrying roads centering in St. Paul and Minneapolis and in Chicago. There is a differential of 1 to 3 cents in favor of Minneapolis and St. Paul, and Chicago railroad men say that large quantities of grain are diverted from Chicago because of the cheaper transportation over the Minnesota lines. The latter lines refuse to raise their rates, and the Chicago lines threaten to cut.

The transportation of bicycles by railways has excited a great deal of conflict between bicycle riders and railway companies in Great Britain. A bill was recently introduced into the House of Commons to provide for the better carriage by rail of cycles. It provides, among other features, that every railway company should afford all reasonable facilities and provide sufficient and proper accommodation in its passenger trains and steamboats for the conveyance of cycles in and by such trains and steamboats. If requested to do so by a person traveling by passenger train or steamboat, the railway company shall convey the cycle belonging to such person in the same train as that by which he is traveling. The schedule specifies a maximum rate of 3d. as registration fee for a bicycle for distances up to and including twelve miles; for any distance exceeding twelve miles, 6d. Proportionately higher rates are mentioned for tricycles and cycles to carry more than one rider; 2d. is the maximum sum specified in the schedule for storage of a bicycle for any period not exceeding forty-eight hours, and 1d. for each additional day or part of a day.

Street Car Mail Service Abandoned.

The mail cars on the Third avenue street line of New York city, which sort and distribute the mail *en route*, are to be discontinued. The agreement between the street car company and the government expires September 1st, and President Vreeland has notified Postmaster Van Cott that a renewal of the contract would not be thought advantageous to the street car company. The mail will probably be transported henceforth over the elevated lines. This will mean a quicker delivery of mail to the branch offices and a discontinuance of the present system of sorting the mail *en route*.

Stealing a Locomotive—A Reminiscence.

BY R. E. MARKS.

Railroad facilities were not as good 'way back in 1868 as they are now, and the difference in gages made it decidedly inconvenient at times, too.

Henry Cramer was one of the best known messengers the Rhode Island Locomotive Works had then, and he had some pretty tough experiences for a quiet man.

In this particular case he was taking an engine to the Chicago & Illinois Southern road, which was a 4-foot 8½-inch gage, and the nearest way was to take it to Jeffersonville, Ind., and float it down the Ohio River to Mount Vernon, 238 miles away. They were eight days drifting down, but finally arrived, put the engine together, and got ready to haul it up the bank on the temporary track laid there. It was a gala day for Posey County, as free rides were to be given the populace on the one lone flat car they possessed. Two fine gray horses were in readiness to help warp it up the bank; but Cramer had sized the thing up, and after waiting for steam, ran the engine up without aid. The crowd cheered, venders' horses ran away and distributed doughnuts and cider broadcast behind them, and Posey County was a prominent part of the country in its own estimation on that particular day.

. . . .

The Chicago & Illinois Southern road was one of the numerous "skin games" that were prolific about that time. It was supposed to run from Mt. Vernon, Ind., to Chicago, touching at Olney, Mattoon, etc.—in fact, any point where towns would issue bonds which could be floated by the schemers. They built the road in chunks, and engines were delivered at four different points. Cramer delivered them all.

. . . .

Two years had passed and the Chicago & Illinois Southern was still in sections for the most part. The bonds had been sold, but the bondholders had nothing to show, except "two streaks of rust and a right of way"—and the locomotives, which had been bought but not paid for in full.

Once more Henry Cramer came to Mt. Vernon, but not with another engine, nor, in fact, with any apparent business. After looking the ground over and locating the engine, he decided to go to the next town and await results.

He kept pretty close to the hotel, and finally found the landlord watching him every minute, and overheard him say: "Don't like ter hev a man in my house 'thout some aparent biznes—always feel kinders tho' they wussnt zactly honest"—and the watch continued. Questions failed to draw Cramer out, and he was on the point of being unceremoniously fired, when the deputy sheriff came in for a consultation, and the landlord's eyes opened wider than ever.

When Cramer had looked around Mt. Vernon he found the engine in the shops of another road, and the foreman took pains to show him how they had altered her, changed her name and number, and finally "guessed not even a Yankee would know her now. And we got her at a forced sale for only $3,500, too."

. . . .

Everything was ready; writs had been secured, and just as the engine came in from her run, the deputy and Cramer stepped up into the cab and served the writ, seizing the engine in the name of the government. There was great commotion. "Fire 'em off, Bill," shouted the foreman to the engineer. But the deputy didn't need a second invitation, and both clambered down.

"Run her in the house, Bill," again commanded the foreman, and the order was promptly obeyed. "Strip her valve motion, boys," came the next order, and the rockers and valve rods disappeared. There would be no running her now without considerable delay. Then turning to Cramer he flared out, "So this is what you were sneaking around here for the other day, trying to steal other folk's engines after they bought 'em and paid for 'em."

"The sheriff don't agree with you as to who's done the stealing," quietly replied Cramer, "and as for sneaking around, if I remember right, you told me all about her yourself and boasted that no one would know her. Don't have to disguise an engine if it's yours by clear title."

"Well, you don't get her just yet anyhow," and the foreman gave a scowl of defiance.

He hadn't noticed the disappearance of the deputy, and had barely started to walk away, when he saw him hurrying back from the telegraph office with a message, and he stopped. A telegraph message generally means something, and especially in the hands of a United States deputy marshall. As he reached them he unfolded it and read aloud:

"Deputy Marshall, Mt. Vernon, Ind.:

"If resistance is made to surrendering locomotive mentioned in writ, call local police or militia if necessary. Should you have difficulty in this, wire me, and will send United States troops. Arrest anyone who resists.

"(Signed) U. S. MARSHALL."

"Gentlemen," he said, "is it going to be necessary to call for force?"

They acknowledged defeat, replaced the missing parts, and finally decided to buy the engine again—this time from its rightful owners.

The railway mileage of the United States at the beginning of last year was 186,800 miles. This is 122 miles more than the combined mileage of Germany, Russia, France, Austria, Great Britain and Ireland, British North America, Italy, Brazil, Mexico, Spain, Japan, Switzerland and Egypt.

At the Rhode Island Locomotive Work.

As with the other builders, the Rhode Island are filled up with work, both present and future. Ten-wheelers for our friend Symons, of the Plant System, and some of Johnstone's heavy consolidations for the Mexican Central occupied the erecting shop when the writer visited the place recently. Besides this, there are engines for the Santa Fé and Queen & Crescent coming along a little later.

There are two classes of the ten-wheeler for the Plant System—one for passenger, the other for freight. The difference is in the wheels, the former being 73 inches, and the latter 66 inches. The cylinders are 20 by 28, and the extended wagon-top boiler is 62 inches at the first course. Mr. G. W. Wildin is inspecting these and is looking closely after details with the object of having the engine especially adapted for their service and of keeping down the weight as much as possible. They are fine-looking machines and give the impression of speediness, which they will doubtless maintain when they get into service. They are fitted with Hancock and Nathan injectors.

The Mexican Central engines are being looked after by Mr. Charles Dunn, who is with the Robert W. Hunt Company, which does the inspecting for about all of the Mexican Central work. They are similar to those built by both Baldwin and Brooks during the past two years, and need no extended description. They are best described as "chunky" engines, giving the appearance of a powerful locomotive in a short length.

Arthur Koppel, of 68 Broad street, New York, has favored us with a copy of his "1900 Album," which contains illustrations from many lands showing narrow-gage railway work he has supplied. The cover is a highly illuminated reproduction of a blacksmith shop, and presents a striking appearance.

We are apt to consider automobiles as creations of our own day, yet the great Duke of Wellington had his own barouche drawn by Gurney's road wagon in 1829. The steam pressure, too, was said to be from 250 to 300 pounds; so it is probable the Duke came nearer getting blown to pieces than he did at Waterloo—but he didn't know it.

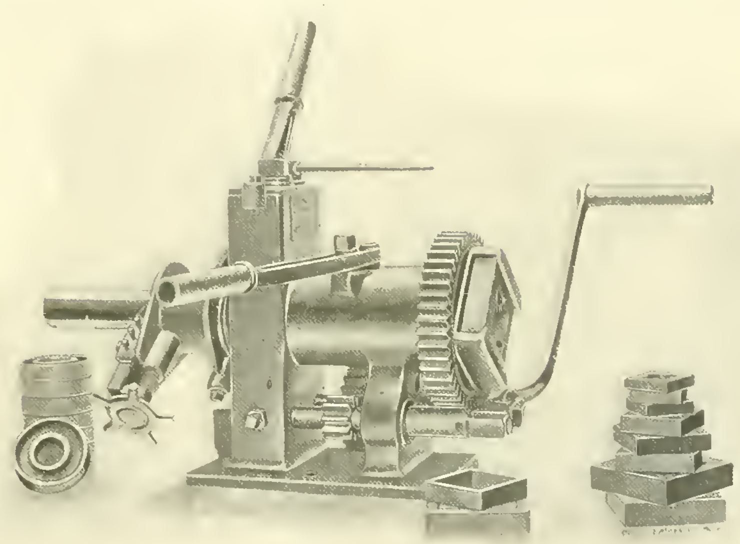
A patent was issued on July 17th for a method of packing tandem cylinders which was used on the tandem compound locomotive of Perry & Lay, in 1867. This was the first compound locomotive in America, and the packing can be found in the cut of this engine which appeared in the *Locomotive Engineer* of May, 1891, page 84. Another of the new-old devices.

Douglas Pipe Cutting and Threading Machine.

This little machine seems to have several good points of its own, and is designed to stand the hard usage such machines almost invariably get from the class of men who handle them. Notwithstanding its solid make-up, it weighs but 75 pounds, complete with dies and guides. It cuts anything up to 2-inch pipe and uses standard pipe dies. There are two speeds, and the faster one can be used for backing a large die off as well as for cutting small pipe.

The cutting-off portion is the handle at the top and left, which is a ratchet. The cutter is fed into pipe by the star-wheel shown.

This is made by P. Hollingsworth Morris, 1500 South Front street, Philadelphia, and seems to be very well adapted for railroad repairs.



DOUGLAS PIPE CUTTING AND THREADING MACHINE.

The Vanderbilt Boiler.

Engine No. 947 on the New York Central & Hudson River Railroad, which was the first one equipped with the Vanderbilt boiler having a corrugated tube, 64 inches diameter and 11 feet long, for a firebox, has lately gone into the West Albany shop for general repairs, such as tire-turning, etc. She has run about a year—freight service altogether—having made her trial trip on August 15, 1899. Her boiler, excepting the flues which are scaled up by the hard water used between Albany and Dewitt, is said to be in very good condition.

A number of these boilers are now being built, some at the Baldwin Works, others at Schenectady; so it can be seen that they are past the experimental stage.

When figures are submitted of their first cost, repairs and evaporative efficiency, we can form a better opinion of their value as compared with a firebox having flat surfaces.

Salvage vs. Justice and Humanity.

The recent disastrous fire in New York which destroyed the piers of the North German Lloyd and three of their vessels, as well as over 300 lives, showed a peculiar phase of marine law and practice. After much signalling tugs were secured to tow the great steamer, "Kaiser Wilhelm der Grosse," out into the stream, where her fire was promptly put out. Most of the tugs hung around the large vessel and let the other burn—more salvage in the large one, you know. For this service a claim of only $1,000,000 was filed as "salvage." A few of the tug captains were so greedy for "salvage" that they refused to stop to rescue men struggling in the water, and actually bargained with them as to saving their lives. Imagine a railroad corporation—soul or no soul, according to the view taken—demanding $5,000 to $10,000 for a few minutes' work in towing an engine out of a fire. Or think of an engineer or fireman refusing to help a man out of a wreck, until he found out if he could pay him. Railroad men are not built that way.

Air-Brake Instruction Book.

We have had an opportunity of examining a bound volume of the "Lessons on the Westinghouse Automatic Brake" prepared for the students in the locomotive running and air-brake course of the International Correspondence Schools.

The four lessons, together with the question papers for each lesson, are handsomely bound in one volume, making a book of about 250 pages. It is profusely illustrated with colored plates of the air pump, brake valve and other valves used in the air-brake equipment. These books are issued only to the students in this course, this being Volume I of the Locomotive Running Course. Something over 8,000 students will be supplied, about 500 a day being sent out.

Dickson Locomotive Works.

This company is busy just now on a lot of engines for the St. Louis & San Francisco Railroad, with 20 x 28-inch cylinders, 57-inch wheel centers—consolidated —having ample boiler power. Superintendent Delaney pointed out some extensive additions and improvements in their buildings and shop facilities under contemplation. Some of this work will be done at once.

The matter of iron axles and crank pins, as against steel, came up during the visit. About as many axles and pins of iron are supplied as of steel. Of course the iron crank pins are case-hardened and ground to a gage fit.

The new triple head slotter installed some months ago was busy working on cast-steel frames.

Thieving Monkeys.

The officials of a small station on the Kram Railway, in Northwest India, were sorely tried by a plague of monkeys. Trucks full of grain for export were often stored up in the station, and the monkeys came down in large numbers from a neighboring grove to help themselves to the grain, picking holes in the tarpaulin roofs of the wagons. The officials were wearied out with keeping watch and scaring away the thieves, who daily grew bolder, till an ingenious guard hit upon a stratagem. For several days sweets and fruits were put on the roofs of the wagons, with the result that the whole of the monkey colony were attracted to the spot, and soon became perfectly indifferent to man. One morning, when they were busily feeding, an engine was stealthily attached to the wagons, and suddenly the train moved off. The monkeys were quite scared, and made no attempt to escape, sitting crouched together until the train had gone several miles and stopped at the jungle; then they wanted no hint to leave. Every monkey leaped, howling, and fled into the jungle, whence they never returned to trouble the railway.—*Railway Herald.*

Among the orders recently booked by the Bethlehem Steel Company are spare propeller shafts for the steamers "Ponce" and "San Juan," of the New York & Porto Rico Line, which are being furnished to Harlan & Hollingsworth Company, of Wilmington, Del. They are also supplying eight forged, hollow shafts of fluid-compressed open-hearth steel for use in Cuban sugar mills, and, in addition to these, are making a large number of gun barrels for the Winchester Repeating Arms Company and Colt's Patent Fire Arms Company. These latter forgings are to be made of Bethlehem nickel steel, which is peculiarly adapted to the purpose on account of its ability to withstand severe strains.

London & North Western Home Industry.

The London & North Western Railway Company, of England, follow the practice of manufacturing nearly everything used on the line, ranging from steel rails to telegraph instruments. Their head manufacturing establishment is at Crewe, where 8,000 men are employed.

On the occasion of finishing the four thousandth engine built by the company all the employés were given a holiday, without loss of pay. Of course there was a banquet given to the foremen, draftsmen and chemists. There were no doubt several small banquets, but that was the principal one, and was presided over by the works' manager, Mr. Earl. The town of Crewe made a special holiday for the occasion, and Mr. F. W. Webb, general locomotive superintendent, had conferred upon him the freedom of the city, which is an act over which great ceremonials are held.

The London & North Western Company employ 78,000 work people, over 20,000 of these being engaged in the locomotive department.

New Compressed Air Motors.

Fourteen new compressed-air motors of a heavier and more highly developed type are now making trial trips on the Eleventh Avenue line of the Metropolitan Street Railway, and the experiments are reported to be very satisfactory. If the final tests are successful, the company will be ready to put the motors into public service about September 15th. During one of the heavy snow storms in New York city, two years ago, when cable and electric cars were blocked to a standstill, the air-motor cars bowled bravely along and proved their staying qualities in the heaviest kind of weather.

At a recent meeting of the stockholders of the Consolidated Railway Electric Lighting & Equipment Company, held at the general offices of the company, at 100 Broadway, New York, the following Board of Directors was elected: Walther Lüttgen, Norman Henderson, C. G. Kidder, George W. Knowlton, Thos. J. Ryan, Isaac L. Rice, Jno. N. Abbott, Aug. Treadwell, Jr. The vice-president and general manager of this company, Jno. N. Abbott, was formerly general passenger agent of the Erie Railroad and subsequently for several years chairman of the Western Passenger Association in Chicago. This company is a consolidation of the various companies heretofore engaged in the manufacture of electric lighting apparatus for all kinds of steam railway cars, the electricity being generated from the car axle while the car is in motion, and furnished from a storage battery while the car is stationary. It is known as the "Axle Light" system of electric lights and fans for railway coaches, and is in operation on various railway lines.

Creditable Work Deserves Better Support.

The Traveling Engineers' Association will hold its eighth annual convention in Cleveland, O., September 11th, 12th and 13th.

Like its sister organization, the Air-Brake Association, the Traveling Engineers' Association has accomplished much good and has brought it directly to the use of the railroads. In the selection of good subjects for papers, good committees to handle them and a good discussion which should follow, there cannot fail to be much beneficial and instructive information brought forth. Representative men from all portions of the country, with its diversified requirements and practices, meeting in dignified conclave to intelligently discuss matters with a view of determining the best method of doing things, cannot fail to bring better results, and consequently saving of thousands of dollars to the railroads. These men, while apparently of modest position and import, are really in position to observe and note important things not visible to a higher and more dignified officer.

It is said that Bosses Croker and Platt, the great political leaders of the Democratic and Republican parties, respectively, in New York, comprehend and fully appreciate the importance of the primary politicians in their less pretentious work. Admiral Dewey, in his report of the battle of Manila, praised the work of the men behind the guns. So did the officers of the Santiago fleet which sent Cervera's ships to the bottom; and they were wise in doing so; for how blatant and discordant it would have sounded had the Santiago commanders said: "*I* did it with my guns," or had Dewey reported: "*I* have sunk all the Spanish ships, etc."

The men of these associations are on the grounds. They are more cognizant of "leaks," and a good man in the position can do more to actually stop the "leaks" than all the paper bulletins ever issued from a high official's office. We use the word "good" in its true sense; for a weak or poor man in any position is a detriment and hindrance to the proper performance of the duties of that office.

High railway officials can give substantial support and encouragement to the work of these younger associations by urging their men to become members and to attend the conventions. A visit to one of the meetings will convince doubtful or indifferent officials "up in the chair" that creditable work is being done and that this appeal for better support by higher officials is fully deserved and warranted.

The Santa Fé is equipping its engines on the Western division with oil burners, and, according to local reports, expects to use about 720,000 barrels a year. They are to have tanks with a capacity of 250,000 gallons at The Needles, Barstow and Port Richmond.

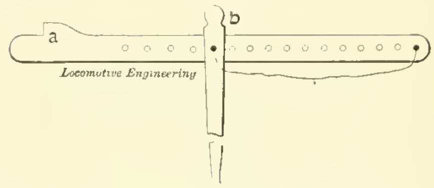
Big Cascade Tunnel of the Great Northern.

President James J. Hill announces that only 800 feet more of the big tunnel on the Cascade division of the Great Northern Railroad remains to be dug. The grades which this tunnel is designed to overcome have been a costly factor in the operation of the Great Northern road. A lowering of rates is promised with the completion of the tunnel, and President Hill says that the advantages to be derived from the tunnel will be so far-reaching that they will be felt in the rates from Liverpool to Shanghai.

Crosshead Mover.

This isn't a new scheme, but it's a good one, and by the way some places bang a crosshead with a sledge, it isn't as well known as it ought to be.

It's simply a bar of about ½ by 2-inch iron with a lip *a* and handle *b*, which



CROSSHEAD MOVER.

slides over the bar. The holes allow its use with the crosshead at any point. We saw this particular one in the Bridgeport shops of the old Naugatuck road, now the Naugatuck division of the New Haven Railroad.

One of the most profitable post offices in the United States is that at Scranton, Pa. The volume of business is unusually large, and is steadily increasing, the figures for the first six months of the present year showing more than double the business for the same months in 1893. This is due principally to the rapid growth of the International Correspondence Schools. Seven years ago the schools' postage was barely 5 per cent. of the total, but now one-third of Scranton's postage is paid by the International Correspondence Schools. Their postage has increased from an average of less than $400 to over $5,000 a month.

The Carborundum Company, Niagara Falls, N. Y., have issued Catalogue No. 3, which is the best we have yet seen. It shows their furnaces and their machinery, so that one gets a very good idea of the making of carborundum wheels. There are points on selecting wheels and illustrations of wheels and other forms of carborundum products.

Our friend, Frank T. Hyndman, master mechanic of the Pittsburgh & Western Railway, has recently been granted a patent on his hub liner, which was illustrated in our June issue.

Electric Lighting

The electric headlight is taking the place of the oil lamp headlight, which gave so dim a light that it was of very little use in locating obstructions on the track in time to avoid disaster.

An electric headlight will show objects far enough away to be of some service. Their cost of manufacture and operation is moderate, which makes the expense of installation moderate. Railroads are finding them a valuable aid to safe operation.

Recognizing this fact, the International Correspondence Schools have placed a Pyle-National electric headlight on each of their air-brake instruction cars, to be used for instruction purposes. This electric light is the same as used on a locomotive, the dynamo and steam turbine motor being driven by steam from the boiler on the car, so as to give an exact idea of the operation of the light in actual service.

From Car Float to Club Boat.

An old Baltimore & Ohio Railroad car float has been recently metamorphosed at Skinner's dock, Baltimore, from an every-day carrier of freight cars into a palace of order, comfort and convenience. A party of Baltimore gentlemen, including many Baltimore & Ohio officials, formed a club, bought the float and fitted it up into a modern and commodious house boat. The floating club boat contains staterooms, lavatories, a dining room, pantry and kitchen, the latter being on the upper deck. On the roof is a space for balls or promenading. An awning will cover it in hot weather to keep off the sun and night dews. The craft will be lighted by electricity. On the side of the boat, in large letters, are the words, "Aquatic Club of Baltimore." Quite a transformation from a damp, plebeian car float to a palatial, aristocratic club boat.

The account of the hot-water pipe that extends back from the top of the cab on the Denver & Rio Grande Railroad, and which is used to scald tramps and train robbers who may be on the platforms of the cars, has reached England, where it is characterized as a "yarn." By the way, did you ever observe a stream of hot water under high pressure issuing from the blow-off cock of a boiler? As soon as it issues from the opening, whether it is from a pipe or the blow-off cock itself, the body of water immediately explodes into a spray and at once cools off, so it will not scald anything. A stream of cold water or one below the boiling point will come out solid, but when under high pressure it becomes a spray as soon as it is relieved from the pressure, so that it assumes the form of an open umbrella. This might wet a tramp, but it would not scald him if he was very far away from it.

"Wind-Splitter's" Fast Run.

A Baltimore report has it that the "wind-splitting" or cigar-shaped train, the product of Inventor Adams, has recently made a phenomenal and record-breaking run on the Baltimore & Ohio Railroad between Philadelphia and Baltimore, the distance being covered in 1 hour and 41 minutes. The record time for this distance heretofore has been 1 hour and 53 minutes, made by the Royal Blue. The report states that the "wind-splitter" started 23 minutes behind the Royal Blue Limited, caught up with her, and consequently lost several minutes because of the necessary slow-down. A rate of 82 miles per hour was attained, and 29.3 miles in one stretch were covered in 24 minutes. The real importance of these high speeds is not of great value; for even limited trains are not run at top speeds, and higher speeds are attained and momentarily held on trial runs than are ever afterwards required by the schedules of regular trains. Undoubtedly the Royal Blue has several miles to the good yet up her sleeve.

Graphite for Automobiles.

Graphite, which plays an important part in the mechanical arts of the world, is found very useful in reducing friction in automobiles.

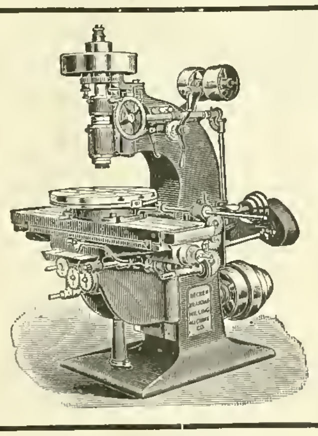
A very finely powdered graphite when introduced into the cylinders of either steam or gas automobiles, very largely assists the oil which is usually employed for the purpose of lubrication.

It seems to be agreed by all engineers that no vegetable or animal oil should be used for the lubrication of engine cylinders. Mineral oil, only, should be used, but even the best mineral oil in the cylinders of gas engines chars under very high heat, due to the combustion of gases. The heat in a gas engine cylinder is said to be from 1,200 to 2,000 degrees Fahr., and graphite only is able to bear this extreme heat.

Special graphite lubricants are prepared for the gears of both electric, steam and gas motors. For the driving chains on steam or gas automobiles, graphite in some form should always be used, as it saves power and at the same time so thoroughly lubricates the links that it will prevent the chains from breaking.

When used for the chain, the graphite should not be used with any grease, as the sticky grease causes the dust and dirt to adhere to the chain, thereby practically shortening the chain and making it unnecessarily tight. The graphite should be used with a nice quality of vaseline or should be mixed with gasoline or turpentine, and applied to the chain. The gasoline or turpentine will evaporate, leaving a thin coating of graphite on the chain.

Those interested in the subject of graphite lubrication should write to the Joseph Dixon Crucible Company, Jersey City, N. J., who are authorities on the subject of graphite.



Pennsylvania's Electro=Pneumatic Signal System.

With a view of reducing to a minimum the chances of collisions, the Pennsylvania has resolved to equip its entire line between Philadelphia and Pittsburgh with the Westinghouse electro-pneumatic signaling system, such as is now used extensively on the busiest sections of the road. Work will be begun in a few days near Philadelphia. The electro-pneumatic system is being introduced on the Pennsylvania's Atlantic City line.

New Railway Construction and Improvement.

Recent published statement has it that certain Western railroad companies are planning to build extensions to the Pacific Coast. C. P. Huntington, president of the Southern Pacific, when asked what he thought of the report, replied that he didn't believe there was much prospect of any important railroad construction in that direction for some time to come, and that railroad men are beginning to comprehend that there are enough railroads in that country for the present. He believed, however, that new construction would go right along, but it would likely be confined mostly to short extensions, alterations or the building of connecting lines, for owners of existing lines would naturally improve their lines in every way possible.

The Chicago Pneumatic Tool Company have issued a special edition of their catalogue, showing excellent views of their exhibit at the conventions, as well as their line of tools. This is increasing, and if one wants to keep abreast of the times it is necessary to send for each catalogue as issued.

The Richmond Locomotive Works have just received, by cable, from the Finland State Railways an order for twelve 16 x 24-inch ten-wheeled passenger locomotives. This is the third order for engines received by the Richmond Works from the Finland State Railways, and is an illustration of the increasing demand for American locomotives abroad.

East River Tunnel for Long Island Railroad.

President W. H. Baldwin, Jr., of the Long Island Railroad, says that hope of an East River tunnel, which will give the road a direct connection with Manhattan, has not been abandoned, and that the road will be very prosperous when it can carry passengers direct from Manhattan to the Long Island beaches and other resorts. He denies the rumor that there is an alliance between the Long Island Railroad and the Brooklyn Rapid Transit.

Swift on Paper.

A Brooklyn inventor has found a syndicate of New York capitalists to back him in a venture to demonstrate the commercial value of a corkscrew boat which is expected to make 50 miles per hour. The capitalists have agreed to furnish $50,000 with which to build a small boat on the cork-screw plan, with the further understanding that if it demonstrates its ability on a commercial scale to approximate the speed which the models have reached, the syndicate will furnish sufficient capital to build a large ocean-going boat.

The boat is cylindrical in shape, with a serpentine flange like a cork-screw extending from the bow to the stern, and the outer shell revolves through the water while the inner compartment maintains its equipoise. It is so constructed that it can penetrate the surf or the waves of the roughest weather. The inventor promises that his craft will cross the Atlantic in less than three days. It looks very fast on paper.

We doubt if any State presents a greater contrast in scenery than the much-maligned New Jersey. Its southern portion is for the most part level and sandy, while in the north we find mountains and lakes that are beautiful to look upon, and make a trip through this section extremely interesting. The Lackawanna route past Lake Hopatcong and through Washington is most enjoyable.

Lightning and Railroad Trains.

Railroad trains are seldom, if ever, struck by lightning, and that fact has produced such comment as to cause an inquiry as to why it should be so. Possibly, if the stroke were heavy or severe enough, the shock might be manifested and felt up inside of the cars of the train; but the rails are such good and ample conductors of the electric fluid, and the contact between the wheels and rails presents so small a comparative area for the passage of the current, that an ordinary stroke of lightning will naturally follow the easy and free channel to the ground, rather than work its way through resisting bodies up to the inside of the car. For this same reason birds may perch harmlessly on live electric wires, and persons, under certain conditions, may likewise touch live wires without receiving shocks. It is all a matter of the current following the path of least resistance and channel of easy and ample passage.

This refers to lightning from the track rails, which are frequently struck without damage, and are nearly always quite heavily charged during a thunder storm. A stroke from above seldom occurs because of the poor conductivity of the car, the rails attracting and carrying away the fluid so much better.

Northwest Wheat Shortage and Railway Hauls.

A personal inspection of crop conditions in the Northwest has been made by President Hill, of the Great Northern Railroad, who says that the wheat crop along the line of his road is about 100,000,000 bushels less than last year. This may seem quite a blow to farming interests in that section and a hardship to lines deprived of hauling the grain to market; but Mr. Hill says it is not nearly so bad as it may seem, because most of the farmers in the Northwest in recent years have gone into more diversified farming instead of confining themselves to wheat raising alone, as in former years. The farmer is just as well, or better, off, and the railroads get about the same amount of hauling.

The Richmond Locomotive & Machine Works are preparing to operate their entire works by electric power. They have contracted with the Virginia Electrical & Development Company for the supply of current, and they hope to have it fully installed by the first of the new year as a fitting commencement of the new century.

The "Locomotive Firemen's Magazine" for August came out in two sections, one of which was the regular official journal of the order, carrying signals for the second section on page 162. The following section has an account of the order since its start, its founders, a summary of its growth and its present condition. Editor Carter shows good judgment in sending his trainload out in two sections instead of making it a double-header—one big load with two little engines. We never did think much of double-headers. The size of the second section, 9 x 12 inches, is also an improvement on the old one of 6 x 9 inches—larger cars and fewer in the train. We understand they expect to make semi-monthly trips when business gets good.

Steamship Line to the Orient.

It is announced from St. Paul, Minn., that President J. J. Hill's scheme for a great steamship line to the Orient has taken shape, articles of incorporation having been filed with the Secretary of State by the Great Northern Steamship Company, with a capital of $6,000,000. It is stated that the purpose of the company is to build and operate steamships on the high sea and other navigable waters. St. Paul is given as the headquarters of the company.

President Hill's scheme contemplates a fleet of vessels larger than any now in existence, of 28,000 tons capacity, capable of carrying the cargo of fourteen freight trains, and his calculations go so far as to lead him to say that he will be able to carry freight from New York to Hong Kong so cheap that competition *via* the Suez Canal will be impossible.

Falls Short of Expectations.

Several months ago a Western report stated that a wonderful new "Vimotum" motor had been applied to the private car of President Cassatt. The car was equipped with the motor at Indianapolis, the place where the engine is manufactured. At the time of application, many claims were made for the motor, and many wonderful results were anticipated. It was claimed that the cost of operation would be about half that of an electric street car, and that President Cassatt's car could be run from Chicago to Pittsburgh, or even New York, without a stop for fuel or water, and at a cost of $18 for the entire trip. The rate of travel promised was 40 to 50 miles per hour. As nothing more has since been heard of this phenomenal machine, it seems safe to conclude that, like many other new things for which extravagant claims are made, the motor has failed to "mote," and that President Cassatt's car will have to be content, for the time being, with the old, prosy steam power of our fathers.

The old saying to the effect that a person is without honor in his own country does not hold true in the case of the International Correspondence Schools. A pamphlet entitled "Home Endorsements" gives twenty-six letters of commendation from business men not in any way connected with the school and practically all of them in Scranton itself, the home of the school. If anyone doubted their standing, this would surely satisfy him.

A recent ride over the Lackawanna road showed that bridges were being strengthened all along the line. The view on this road from Paradise or Mount Pocono, after we have left the Delaware Water Gap about twenty miles behind, is one of the finest in the East. We have climbed nearly 2,000 feet above sea level, and looking back, the famous "Gap" is clearly seen, outlined against the sky.

The Richmond Locomotive & Machine Works have just received an order from the Intercolonial Railway of Canada for ten consolidation locomotives with 56-inch drivers; weight in working order, 164,000 pounds, with 147,000 pounds on drivers. The boilers are of the straight-top type, 66 inches diameter at the smoke-box end, and will carry 200 pounds steam pressure. Five of these engines will be compounds, with 22½ and 35 x 30-inch cylinders.

The Garden City Sand Company, 1201 Security Building, Chicago, Ill., have issued a particularly attractive little booklet, called "Inside Facts," telling the merits of their cement, fire-brick and general building supplies. It contains some striking testimonials and is decidedly interesting to those in need of such goods.

Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

Vol. XIII 95 Liberty Street, New York, October, 1900 No. 10

Locomotives and Other Things in the Paris Exposition.

EDITORIAL CORRESPONDENCE.

Paris, Aug. 25, 1900.

When I was gathering impressions of the greatest exposition the world has ever seen and writing my last letter, a conflict was going on between me and the temperature. Walking about in glass-covered buildings with the thermometer lingering close to 100 degrees Fahr. in the shade, with no breath of air stirring, is decidedly distressing. I endured it for one week and then hurried away to Scotland, where I found the temperature as much below our comfortable weather as it was above it in Paris. Since then I have visited various places in England, France, Germany and Switzerland, and now I am again in Paris, spending the days in the Vincennes exhibits and the evenings in the Champ de Mars.

The magnitude of the Exposition grows upon me from day to day, but the finish, the artistic character, the ingenuity, the boldness or delicacy of designs impress me more than similar characteristics of the numerous exhibitions I have previously visited.

Anyone who is fond of looking into well "dressed" store windows is certain to enjoy looking at the various exhibits, for they partake very much of store-window displays, presented in the most artistic form. Of course the engine and machinery exhibits have not much of the store display about them, but they are not materially different from the exhibits seen in Liberty street, New York, only on a larger scale. Manning, Maxwell & Moore, the Q. & C., Pratt & Whitney, the Niles Tool Works and others have displays in stores in Liberty street that prevent some of the leading exhibits in Paris from conveying the impression of great novelty or originality.

EAST FORK FROM ROCKY POINT, WHITE PASS & YUKON ROAD.

While referring to originality of designs, I noticed that there was a slavish touch of imitation of the best American models among European toolmakers. This is much more apparent to-day than it was at the Exposition of 1889. At that time European machine tool builders had come to understand that only a few tools, such as milling machines and special tools of American make were worthy of imitation.

The machine-tool world of the United States has gained great celebrity since that time. The boom that arose in Europe about five years ago in favor of American machinery of all sorts has set manufacturers on the other side to thinking and they are doing their best to follow the American lead, even to the extent of making pneumatic tools. I examined one extraordinary pneumatic drill of German manufacture that would make Boyer's hair stand on end; but it is not likely to force him out of business.

The various buildings about the Champ de Mars contain what would be regarded as a good supply of machinery, but the railway man finds the greatest attractions at Vincennes. There are a variety of buildings, none of them being of an imposing character, the principal ones being those devoted to railway rolling stock and the machinery exhibit. The rolling stock building is an oblong structure, not unlike certain unpretentious railway stations, with tracks for holding the exhibits, with plenty of room for visitors passing alongside. The different nations having exhibits here have track space assigned to them, and each part is profusely decorated with national flags. Most of the engines and cars are beautifully painted and are dazzling with polished steel, brass and nickel. The colors are wonderfully diverse, and, along with the flags and other decorations, make a most impressive sight.

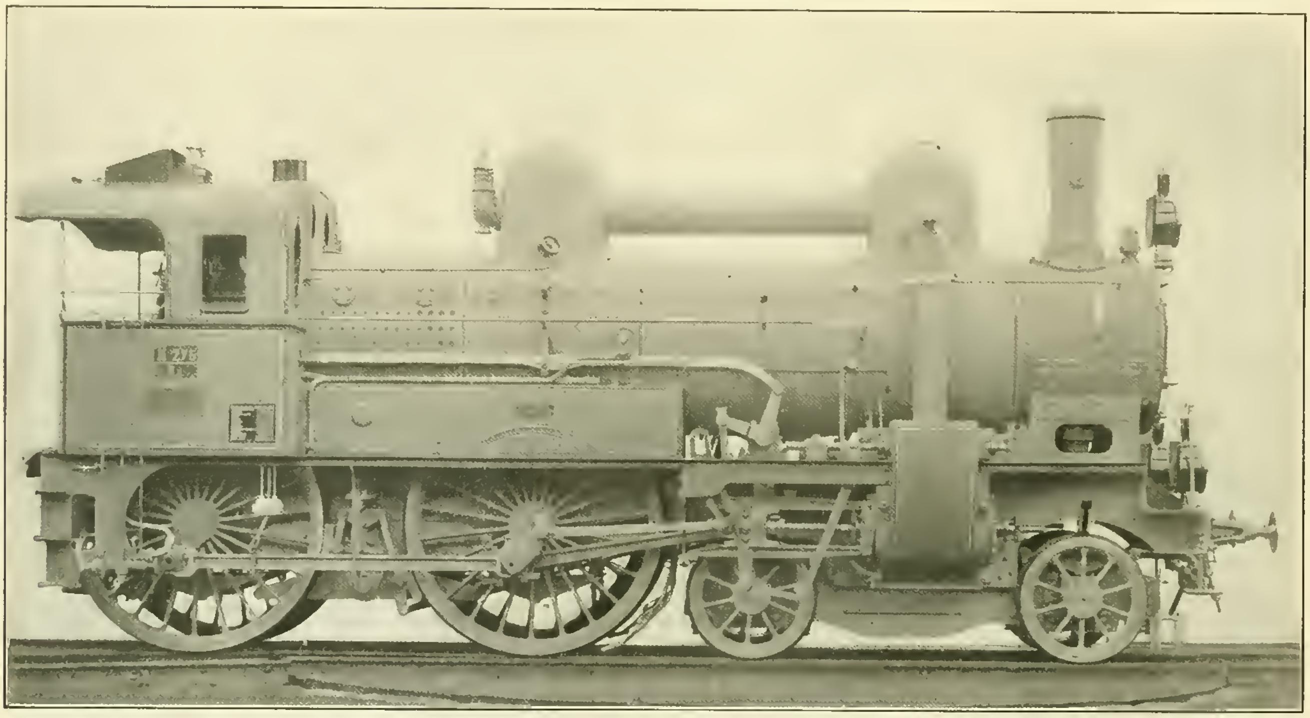
On getting down to details on a leisurely tour through every aisle, the impression given is: How fearfully complicated nearly all the engines are outside of the American and British exhibits. British locomotive designers take pride in covering up all the working parts, and their engines present a very smooth and neat appearance. Continental locomotive designers do not, however, seem to care how many rods, levers, pipes and brackets they expose to view. From an artistic standpoint, there has been a decided improvement made on the outside of locomotives since last exhibition, but there is still room for more improvement. The square section of smokestack that used to be so common with Belgian and French locomotives has disappeared, and the beer barrel-like domes and sand boxes have had their crude outlines toned down. The Walschaert valve motion, which had a feeble life in America at one time, appears to be growing in favor among continental designers. As the motion is all outside, and as speed-recorder levers, lubricating-pump levers and other contrivances are frequently attached to the connecting rods, the appearance when running is wonderful to behold.

It used to be the custom to provide little or no protection for enginemen, and during my present rambles I have seen locomotives at work that had no shelter whatever. This exhibition indicates that the cab is increasing in favor and in size. A fair proportion of the locomotives exhibited have cabs made after American patterns. In this respect English engines lag behind, the only exception being the Baldwin engine for the Great Northern of England and a Great Eastern oil-burning engine.

The locomotive exhibit, and indeed all the exhibits both at Vincennes and at the Champ de Mars, are remarkably free from freaks, except in the departments of automobiles, where there are some amazing examples of ingenuity exhausted in making complicated apparatus. There are some locomotives that are decidedly odd in appearance and construction, but they are all practical machines that can haul trains. There is a powerful ten-wheel tank four-cylinder compound engine belonging to the Southern Railways of France. It has two outside and two inside cylinders, with piston valves all secured in front of the smokebox, which is nearly as long as the boiler. The engine is a powerful machine, having cylinders 15 and 22 inches diameter, with a stroke of 25.6 inches. The three pairs of coupled drivers are 76 inches diameter. The cylinders are secured by a half-saddle arrangement fastened between the frames. It seems to me that a little hard service would work the whole thing loose. This engine is intended to run cab first, and has a wind-splitting end.

There is another curious engine, built for the Bavarian State Railways. It is a four-cylinder compound and has six pairs of wheels altogether. There is a six-wheel truck in front, and the high-pressure cylinders transmit power to the middle pair, which thus become drivers. The exhaust steam is led back in pipes inside the frames to cylinders that are secured outside of the frames under the cab. The power from the low-pressure cylinders is transmitted to two pairs of drivers, about 65 inches diameter, arranged in the Atlantic type style. A pair of carrying wheels under the hind end completes the outfit.

As we stroll through the French section, on entering the exhibition sheds, the familiar form of a Baldwin compound looms up, surrounded in all directions by lever-loaded French engines. The engine was evidently built for business and not for show, which makes her compare un-



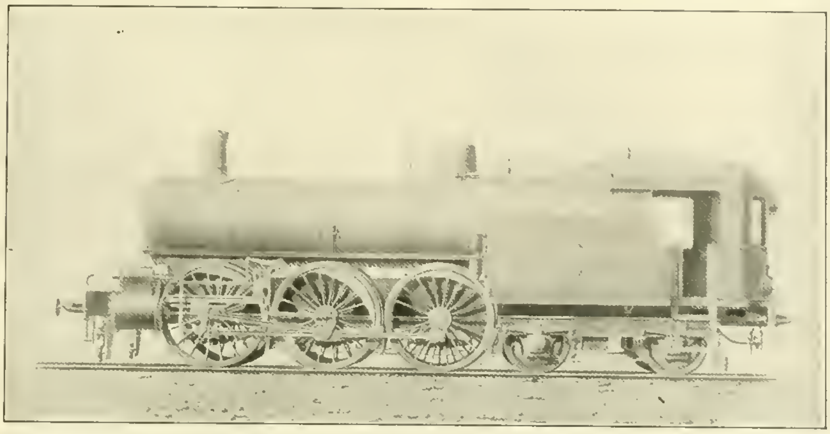
PRUSSIAN STATE RAILWAYS—PARIS EXPOSITION.

favorably with the gaudily decorated and elaborately finished engines in the neighborhood. We illustrated this engine in the March number of LOCOMOTIVE ENGINEERING, so I need not give any particulars. This engine has been distinguished by being the subject of a discussion in the French Chamber of Deputies. The engine was built for the State Railways of France, and was ordered by the Minister of Public Works after he was ordered not to purchase locomotives in a foreign country. The presence of the engine in the French exhibit gave great offense to certain deputies, and they assailed the responsible Minister about his unpatriotic action. Part of his defence reads droll to an American who has examined the offending engine. He said that the machine was built to improved designs of French engineers. The Baldwin engine was therefore the outcome of French genius. This explanation satisfied most of the deputies, but some of the irreconcilables wanted to know why all the locomotives were not built at home, and why, if it were necessary to exhibit a foreign locomotive, it was not shown in the foreign section. The Minister then replied that he was a locomotive engineer himself and that the objectors did not know what they were talking about.

The Baldwin mogul for the Great Northern is in the American exhibit, and has an interested crowd about it every day. The engine is jacked up and the motion is operated by compressed air, and it is about as attractive to visitors as a free circus.

The Richmond engine that was sent to the Exposition through appalling difficulties has not been set up. The boiler and driving wheels are outside the building and the leading truck inside. It is a melancholy spectacle and makes Americans fierce to think of the scandalous treatment the owners of the engine have received.

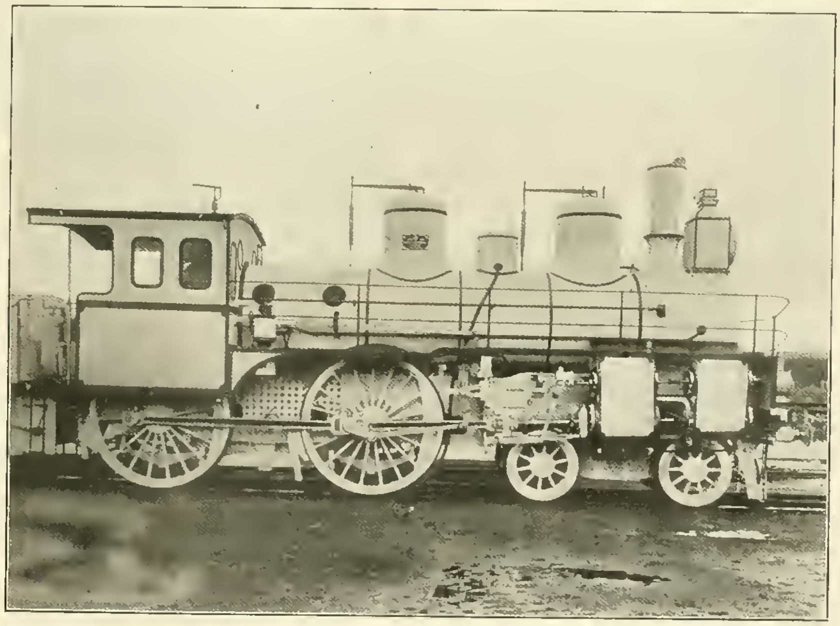
There are so many locomotives in the great shed that merely to give leading dimensions would make a long letter. The fullest display is naturally made by the French railways, and the engines represent fairly well the trend of continental practice. Compounds of the four-cylinder type are becoming the favorite motor for all kinds of passenger service, and they are advancing into favor for freight service also. The boilers are large, providing from 2,000 to 2,500 square feet of heating surface and about 25 square feet of grate area. To obtain these dimensions the center of gravity is necessarily high—about 8 feet 3 inches above the rail being an average. The Atlantic type of engine is coming greatly into favor. A very fair specimen of this engine is shown by the Northern Railway of France. It has high-pressure cylinders, 13½ inches diameter, set outside the frames, and low-pressure cylinders, 21 inches diameter, under the smokebox. The driving wheels are 84 inches diameter, and the boiler carries 220 pounds steam pressure.



ITALIAN ADRIATIC RAILWAY—PARIS EXPOSITION.

There are a few two-cylinder compounds, and I noticed one with three cylinders. In the Russian exhibit there are some curious specimens of. compounds. Several have the cylinders all outside and set tandem. They have piston valves placed above the cylinders, both valves being actuated from one connection. Another Russian exhibit is of the Fairley double-ended articulated type, that used to be a favorite with William Mason, of Taunton, and was a favorite for narrow-gage roads. Many American engineers remember this form of engine, and the reminiscences as a rule are not of a joyful kind. This Russian engine is compound, the high-pressure cylinders being at one end and the low-pressure on the other.

Great Britain makes but a small display of locomotives, the strained relations that existed between that country and France some time ago being responsible for so many British manufacturers that usually send their products to exhibitions, keeping away from this one. If the British display is small, it is very select and excited much attention. The London & Northwestern is better represented than any of the other interests. They have a four-cylinder compound, a passenger car, a large screen of interesting pictures, a variety of models of signaling apparatus and a model locomotive operated by the penny-in-the-slot system. The Midland Railway have a "single" express engine, which is the only engine in the exhibition with a single pair of drivers. The Great Eastern exhibit "Claud Hamilton," was shown in the July number of LOCOMOTIVE ENGINEERING. The engine is painted a deep blue, trimmed with gold and makes a very handsome sight. A very sensible-looking engine is a ten-wheel passenger engine designed and built under the supervision of Mr. Worsdell, locomotive superintendent of the North Eastern of England. The East Coast Route of Great Britain exhibit a most luxuriously fitted up sleeping car, which has Gould automatic couplers, Gold steam-heating apparatus and is carried upon two pairs of six-wheel trucks. There are a number of other sleeping and saloon cars exhibited,



ST. PETERSBURG & WARSAW RAILWAY—PARIS EXPOSITION.

but none of them begins to compare with this one in artistic finish both of the decorations, the woodwork and the upholstering.

The mention of automatic couplers reminds me of a very ingenious thing done by the Janney coupler people. An almost insuperable obstacle in applying an automatic coupler to European freight cars has been that the coupling is in the form of a chain and the buffing done by side buffers above the rails. The Janney people exhibit an English freight car with couplers secured to the end of the buffers. They propose to abandon the middle coupler and do the business on the sides.

As this letter is long enough for the space available, I shall have to let the other notes lie over to another issue.

There is one thing in connection with this Exposition which I think deserves to be commented upon. All over the Exposition at the Champ de Mars and at Vincennes, a visitor finds any number of good exhibits with no attendant who can give any intelligent information about the display. I heard numerous complaints that the Exposition has proved a great disappointment from the exhibitor's standpoint, as it has given very meagre indications of coming orders. Others were very highly satisfied. The dissatisfied men are those who spent a lot of money installing an expensive exhibit and then paid no more attention to the bringing of its merits before prospective buyers. The exhibit was permitted to stand dead and dusty, and the person in charge very often could talk nothing but English or French, and was devoid of technical knowledge concerning the display. The exhibitor who is going about with a smile of satisfaction on his face had keen, active men in charge who were zealous to dilate on the merits of the exhibit and knew how to talk intelligently about it. If they had apparatus capable of moving, it was kept going and attracted attention. It is the old story of the advertiser who puts an ad. into a paper and then pays no more attention to it. He concludes after a time that advertising does not pay. The man who nurses his ad. and makes it attractive says nothing pays so well as printers' ink. S.

Locomotives at the Paris Exposition.

We have already illustrated some of the American locomotives at the Paris Exposition, and are glad to show some of the others.

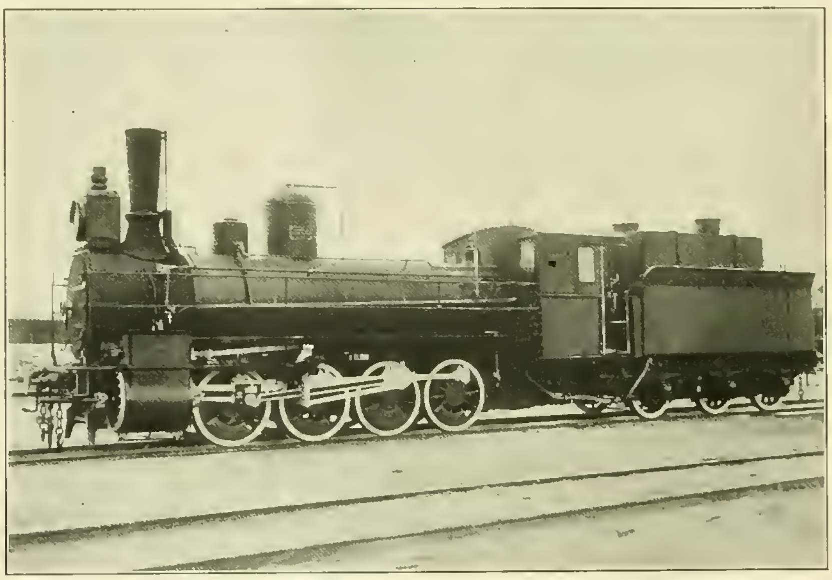
The Russian Government Railway show one of their eight-coupled freight engines, with cylinders 19.7 x 23.62, driving wheels 43.3 inches. It is an oil-burner and carries 180 pounds of steam.

The Italian Adriatic Railway have a six-coupled four-cylinder compound express engine. The high-pressure cylinders are 14.57 and the low-pressure 22.8, with a stroke of 25.6 inches. The cylinders are said to be arranged with the two high-pressure on one side of the engine (one inside the frame), and both low-pressures on the other side in a similar manner, all being coupled to the main pair of wheels. A sketch of this connection would be interesting, as the forward axle seems to be in the way. The drivers are 76.38 inches, and boiler pressure is 215 pounds.

The St. Petersburg & Warsaw show a tandem compound express engine with cylinders 17.32 and 25.2 by 26 inches stroke. The drivers are 78 inches, and the boiler carries 200 pounds of steam.

The express engine of the Prussian State Railway has two domes, outside steam pipes and Walschaert valve motion. We have not the exact dimensions of this engine, but judge it has about 19 x 24-inch cylinders and drivers of 78 inches. As it is not compound, the pressure is probably 180 pounds.

The Bavarian engine is something of a curiosity, with its steam-driven truck, and gives the impression of a very long engine. All its connections are not quite clear, but we hope to have details later. The front cylinders are 10.24 x 15.75 inches, while the main cylinders are compound, with the high 17.32 and the low 25.6 inches in diameter by 26 inches stroke. Drivers are 74 inches in diameter, while truck wheels are 40 inches, almost. Steam pressure is 200 pounds per square inch.



RUSSIAN GOVERNMENT RAILWAY—PARIS EXPOSITION.

The drivers of the leading truck are not flanged, and do not normally rest on the rail, but are held up by springs acting on a bell-crank arrangement. When it is necessary to increase the hauling capacity, steam is admitted to two small cylinders, also connected to the bell crank, which force the wheels to the rails.

The counterbalancing of the reciprocating parts is also novel. Heavy cast-iron crossheads, moving in opposite directions to the pistons, are operated by special connecting rods. It seems to be a case where the remedy is worse than the disease.

The Niles Tool Works' Catalogue.

There are catalogues and catalogues. Some are so cheaply gotten up that no one ever keeps them, as they disgrace his desk; others are fair, some good and a few can be called really fine. The one in question, Catalogue 5, is unquestionably the finest thing of the kind we have seen. Its covers are of embossed flexible morocco and lined with kid, while the name of the fortunate recipient appears in gold on the front. Its 170 odd pages of 9 x 12 inches are of excellent quality that brings out the half-tone illustrations of their shops, as well as their line of tools, finely. Beginning with a map of the Paris Exposition and locating their exhibit, you travel through their shops in Hamilton, and whether you are English, French or German you can read about all you see.

The tools illustrated comprise the well-known line manufactured by the Niles Tool Works, and impress one with the idea that almost anything in the line of heavy tools can be supplied by them. The latter portion of the book is devoted to views and descriptions of some of their tools in use in various places, and the number of countries represented shows that their claim to a worldwide reputation is well founded.

Coal to Back up Natural Gas.

While there has been a general falling off in freight shipments, there has been a notable increase in the quantity of coal carried into the manufacturing districts of Indiana and Illinois. Inquiry discloses that many of the Western manufacturers are putting in a good stock of coal, for fear that the supply of natural gas which they now use as fuel may give out before the winter is over. Natural gas is a splendid and superior fuel, but its fickleness in cold weather has taught its users a lesson. A coal pile on the side is a valuable adjunct to the fluid fuel.

Mechanical Examination Questions.

A good deal of the prejudice against examinations comes from the character of the questions asked of the candidates for promotion.

We used to think it a poor plan to give out a list of questions to be asked at examinations, as the candidates would not try to post themselves on any points not brought up by the question list, and there was danger of an examination being a test of memory in remembering the set answers to the questions, instead of a correct understanding of why the operations were necessary.

The publication of a list of questions has a good effect, however, for the running fire of comments on any questions with a doubtful meaning tends to call the attention of all to these questions and brings about a weeding-out process with the questions that have no direct connection with the work of a locomotive engineer.

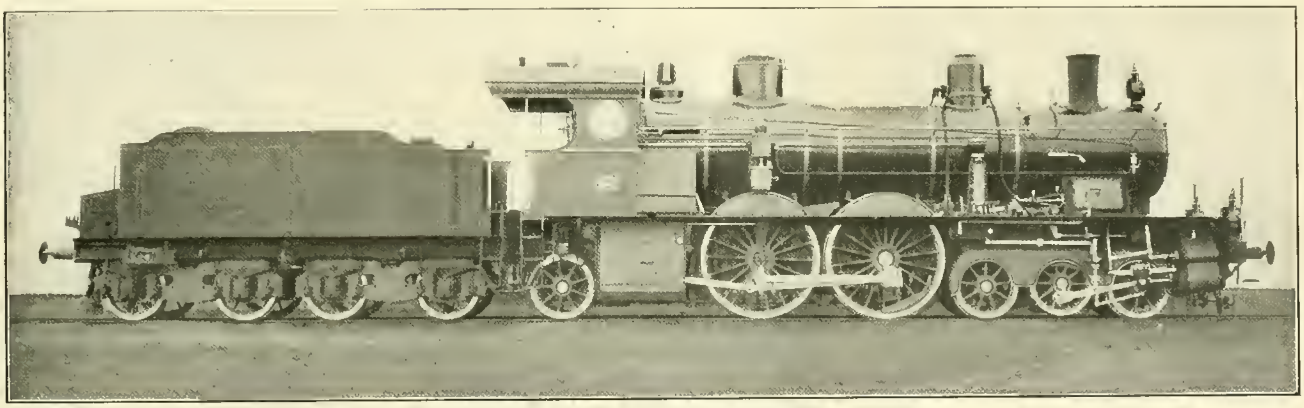
Many of the best managed roads have a printed list of questions for examination, which is given out to candidates for promotion and others who wish to study up on the matters they should know, to be successful.

Some companies follow the progressive system, having one set of questions for the first year, another set taking up points farther along for the second year, and the full and complete examination at the end of the third year, or whenever they come up for promotion.

Questions should be to the point, and about the operation and handling of a locomotive and train, whether in good order or disabled. They should be in correct language, with no side issues concealed. Each point should have a separate question, even if it does make a long list. Better take time to ask several separate questions, than make it necesary to give long explanations when answering any one question.

When the work of disconnecting after a break-down is being done, only one thing can be done at a time by each man; make the questions come in the proper serial order, one at a time. We have heard of many questions that are on the examination lists, and have seen some of them that would not stand the criticism of practical men in case the lists were made public, so that the officers and employés had copies of them. Some of the questions we think open to criticism are, "How many staybolts are there in the firebox of the boiler you are now firing?" "How do you compute the horse-power of a locomotive?" "Explain the chemical composition of water," etc. If this item meets the eye of an examining officer who has a great many technical questions for the practical men to answer, we hope that it will induce him to make his list so intensely practical that it will do his men good to get hold of it and make them experts in their business before they come up for examination.

Examination questions have a double duty to perform—they serve first to call attention to what a man should know if he wishes to excel in his business, and at the same time they give him an idea of what is most necessary to know, so that he will not spend his time learning about things of minor importance when there is little enough time to learn the very important facts.



BAVARIAN STATE RAILWAY—PARIS EXPOSITION.

Additional Rules.

It used to be the custom after an accident, when someone had made a mistake or a blunder, to make another rule for that special kind of a case, and thus each accident brought forth a new rule intended to do away with that class of disasters in the future. Rules, however, will not prevent accidents; most of them occur because someone violates the rules already in force.

In a great many cases rules were so framed with a view to locate the responsibility in case of a smash-up. A prominent railroad officer once put it very cleverly, when he stated that "railroading is the science of shifting the responsibility."

A multiplicity of rules has a bad effect, especially if they are so worded that it is hard work to tell just how they should be interpreted: it also tends to have more than one on the subject to suit various conditions.

The tendency of the Standard Code is to condense and reduce the number of rules for train service. This is a good sign; we hope it may be followed up in the special rules considered necessary by each company.

A Good Combination.

The summer number of the *Locomotive Magazine* is devoted to "Locomotives of 1900," and shows a number which are exhibited at Paris. There are also five fine inserts—some of them in colors—which will interest any railroad man.

We have had numerous inquiries concerning the *Locomotive Magazine,* and believing it to be an admirable paper for those who wish to know what is being done on the other side of the water, we have arranged to take combination subscriptions for both papers at $2.50 per year. This secures both the *Locomotive Magazine* and LOCOMOTIVE ENGINEERING for one year. Foreign subscriptions can be sent to F. Moore, 102A Charing Cross Road, London, W. C., at 10s. 6d., or 13 francs.

About Nebraska.

Nebraska has no bonded debt.

The last bonds outstanding were redeemed and canceled June 2, 1900.

During the past twenty years the wealth of Nebraska has increased 155 per cent.

Statistics show that in Nebraska only 31 people out of 1,000 cannot read or write. This is the best showing made by any state.

Eighty per cent. of Nebraska farmers own their own farms.

Nebraska originated Arbor Day. In a single year Nebraskans planted 66,937,494 forest trees.

In the whole United States, 722 out of every million inhabitants are convicts. In Nebraska alone the ratio is only 369 in every million.

In 1898 1,100,000 sheep were fattened for market in Nebraska.

The Locomotive Engineer in the far far North.

A GLIMPSE INTO THE HOME LIFE AND WORKING CONDITIONS OF LOCOMOTIVE ENGINEERS IN SIBERIA.

BY L. LODIAN.

Some previous papers on the writer's trans-Asiatic travels treated chiefly of the great Siberian railroad in general. In the present chapter I will give the reader an intimate insight into the Russian locomotive engineer's life in Siberia.

While his monthly earnings for mileage average 110 rubls ($55), he often gets, in Siberia (but not in Russia), free quarters and firewood. But the free quarters usually only amount to a couple of ordinary-sized rooms. Then he has, once a week, the privilege of the Russian bathhouse—a certain day in every seven being set apart for the enginemen (which of course means that the firemen come in for their share).

The engineer's home has none of the conveniences you will find in the abode of his American confrère. Hot-water supply, ice-chest (for the Siberian summers are almost tropical), piano, proper house-heating—of these he knows not. I had traveled 6,000 miles overland from the Pacific ocean before I saw a piano in a Russian locomotive engineer's apartment. That was near Peterburg.

LOCOMOTIVE ENGINEERS' WIVES.

A couple of portraits of the wives of these engineers, I have preserved. They reveal good, educated types, and show a neat and sympathetic costume in which the wife (or wife-to-be) or daughter of any American engineer would look well.

One thing in the Russian engineer's home I did not like—his habit of treating his wife as belonging to a station in life inferior to the masculine; but fortunately there are exceptions. By "inferior" I mean this: I have sometimes partaken of food in the engineer's room, and he would relegate his wife to a separate small table, considering her "not good enough" for the society of men. The poor wife is similarly ostracised in most of the walks of life of the Russian poorer middle classes. After a while, I used to protest against this; told the engineer his wife was a better woman than he was a man, and insisted upon her faring at the same table. Instead of offending, this request pleased both—for the engineer felt proud of his wife being considered something more than "only a woman," but had hesitated to ask her to place herself at the same table. Alone, however, the couple always fare at the same board.

If there's one thing a poor wife feels keenly, it is being ostracised. For a man to be "cut," it matters little, unless he is a society loafer.

Of amusements in Siberia, the locomotive engineer has none beyond card-playing, and (in summer) an excuse for a gymnasium. Sometimes he goes sledging, but does not consider it an amusement. The sledge and horses are his, costing but little. See those horses go, three abreast, over the snow-ice! Social purity is a feature of Russian rural life, and I have sometimes been invited to accompany the wife of a Russian engineer going for a drive alone (the husband being busy). Now, the body of a Russian sledge is very narrow—maybe designedly so. It is a squeeze-in for two. Your arm is in the way—so whenever you are invited to a sledge ride with a Russian woman, you act gallantly, and slip your arm around her waist. The etiquette of this is to save her or help her in the case of the sledge capsizing—of course! But, encased in her thick fur, you can't get much hold. Still, done respectfully, it's nice. The real charm of friendship for a woman consists in one word—*respect.*

In eastern Siberia, some of the section engineers I stayed with could not get a wife to accompany them from Russia. So, for housekeeping, they would employ a woman of the nearest village, calling her (in Russian) an "ekohom," pronounced ekonom, meaning economy—an economical manager. I am afraid some of them proved an "economic loss." As one of the engineers I put up with had been presented a fortnight previous with lusty twins (whose lung-expanding squealings in another room meant business), I failed to see where the economy came in. The law of production teaches us that multiplicity means economy; but the engineer also failed to "see the point," and "looked aghast" when I suggested there might be "three next time."

HOW ENGINEERS FIGHT THE SIBERIAN COLD IN WINTER.

The cabs are ill-provided to keep out the icy blasts of a Siberian winter. What protection there is, the engineer and fireman have rigged up for themselves. They board up the cab at the junction of the tender, leaving a narrow doorway for ingress. Some use sail-cloth, but this last is generally used by the fireman as a protection while getting at the coal.

All the water-towers are boxed in and fires kept going month after month, to prevent any accident from freezing. The cars have their own stoves. It would be risky to rely on the engine for steam heat; for in case of a break-down in the middle of a gust-swept Siberian plain, the passengers would succumb after a few hours.

Mileage runs are not long, averaging 120 versias—say 75 miles. Still, it takes some of the trains five or six hours to do even that. Anything like a through 30-mile speed—even only half a mile per minute—on the trans-Siberian will be an exception, not the rule. The calculations of "overland from Calais to Vladivostok in fourteen days" should read twenty-four days.

C. Peh, Phot., Cipoctah (Urals).

THREE-SPAN BRIDGE ON THE CAMAPA-ZLATOYCT RAILROAD, EASTERN RUSSIA.

"WHAT THEY WOULD DO WITH GOMPERS."

There is not a single locomotive engineers' or firemen's protective association in any part of Russiadom (by which, of course, is included all Siberia and other parts of Russian Asia). It would not be countenanced by the authorities for a day. An individual like Gompers or Eugene Debs would be classed as a "dangerous anarchist," and the authorities would not even take the trouble to buy him over, but give him an acute dosage of Siberia-fobia; *i. e.*, he would be sent to the land of bugs, and then he would (officially) "disappear." Police report: "Escaped to woods, and disappeared."

SOME CLIMATIC CONDITIONS.

The extreme purity and dryness of the Siberian wintry climate render some things deceptive to the newcomer. Thus, at night, a station light appearing to be two miles off may be ten miles. The whistle of a locomotive, apparently approaching a station, is in reality its starting whistle from a station eighteen to twenty miles distant. Shunting is distinctly audible at those distances. To speak to a man half a mile distant, it is scarcely necessary to raise the voice above an across-the-table conversation. So hushed is everything, with not even a breath of wind, that a candle flame in the open air will not flicker hour after hour.

New York.

An Important Railroad Extension.

Announcement has been made that the Burlington's new line between Alliance, Neb., and Brush, Colo., will be formally opened to general traffic September 15. The new branch is 149.69 miles long, and is laid with 85-pound steel rails. It will make a short route between Denver and the rich mining districts of South Dakota and Montana.

The new line connects with the system's Guernsey extension at Northport, Neb., and practically opens up a new transcontinental railway between Colorado and points in Montana, Washington and the North Pacific Coast. Under existing conditions the Burlington's traffic between Denver and the Black Hills must be handled by way of Lincoln. The new cutoff will reduce the present distance 673 miles. A passenger will be able to leave Deadwood in the morning and reach Denver the same night.

The new line will be of marked importance to the lumber and shingle interests of the Puget Sound district, as it will open up a new market. This trade is now to a great extent shut off from the Colorado markets because of the long haul.

The expressions "open" and "crossed" eccentric rods are apt to confuse some, for in reality all link-motion rods are both open and crossed at a portion of the stroke. Most men understand it, however, and it is not easy to give a single name that will describe it even as well as they do.

The New General Foreman.

BY R. E. MARKS.

When the P., R & X. road changed hands last year everybody thought an earthquake had struck town, and there wasn't much suspense waiting to get fired either, for the new crowd was all ready to drop into place. There were exceptions, of course, and one of them was the general foreman, who for some unknown reason was not disturbed—overlooked, probably—but he was on the anxious seat for many a day.

One day they seemed to discover that he was out of date, too, and so he "resigned" also. "Resigned" possibly looked better than "fired" when it first began to be used, but it's so common now-a-days that you naturally think every resignation has the same reason behind it—"by request."

Well, when Taylor walked the plank, one of my friends, John Lawson, was appointed (we used to get "jobs" years ago) in his place. Lawson is an honest sort of chap and a good man for the place, and I was anxious to see how he found things, so I went to see him last Sunday and he took me down to the shop to show me the place as we talked. I saw something was on his mind by the way he looked and knew it would come out in time, so I waited. It came before long.

M. Xaletckaia, Phot , Jogobo, Polska.

Latpabiata, Phot., Ekaterinb, Cibip.

WIVES OF RUSSIAN ENGINEERS.

"Tell you what it is, Marks," he said, "I'm beginning to think things ain't divided up quite as square as they might be and to lose faith in my own ability as well. Not that I think I'm getting woozy, Marks, old boy; but I don't believe I know so much more than other folks as I used to think.

"Now, take Taylor, who had to step out of my way. He's one of the brightest chaps I've met in a long time, and, between you and me, the company would have been money in pocket to have kept him. First place, he knew the ropes, had the run of all the engines, and the men couldn't fool him; next place, he had lots of good ideas and carried out all they would let him; but they wouldn't give him a show, because they thought he must be a fossil—he isn't though, by a long ways.

"First day I was here Taylor came in and introduced himself. Says he, 'Mr. Lawson, I haven't a single grudge against you, not one; and I remember when I first took hold here. Everything was Greek to me, and I thought I might put you straight on a few things, if you don't mind.'

"Of course I thanked him, and we started round the shop.

"'Here, Mr. Lawson, is an old boring mill that ought to be scrapped. It *looks* like a fair tool, but I'll bet you'll be sorry I didn't smash it, after you try to run it awhile. If you insist on a new tool, you'll get it—I used to when I was *new*—and you never want to get *old* in a shop; I've learned that.

"'Here is a big lathe which ought to have a small crane over it for handling work; then it'll be O. K. This engine [for we had reached the roundhouse] needs more looking after than any two of the others; she's a —— and a terror on flues. Then there's the "307"—her regular crew get along fine, but anyone else has trouble. You've seen those engines before.'

"Well, Marks, he went on and told me things about the place, the machines, the engines and tools, till I ought to know 'em as well as he does. And the suggestions he gave me as to improvements he wanted to make and couldn't get permission, made me feel like the 'thirty cents' they tell about on the Bowery.

"Now, I always considered myself a pretty good foreman, and in fact have imagined that I could hold down an M. M.'s chair in fair shape; but they made a mistake by firing Taylor and giving me the job. If they had given him the same chance they have given me, he would have made just as good a showing as I can—and I'm not ashamed to say it either.

"I suppose I ought not to give the snap away, as I have a good job by it; but this fever for having new men is costing a lot of money to railroads every day. Of course, changes are necessary; but I've learned this much, that it pays to give your old man a chance, and not kick every time he wants to make any alterations, when a new man could turn the place upside down and you'd think he was a hustler. Just give 'em a fair chance and there'll be fewer changes in the different departments, I'll bet a red apple."

As I said before, Lawson is a fair man—one of the fairest I ever met; and, by the way, Taylor seems to be a pretty "white" kind of a chap, too. At any rate, I believe Lawson is right about giving the old (or present) men a show before having a wholesale beheading bee. Perhaps being an old hand myself may influence my belief, but I fancy there are others who have noticed this tendency to give the new man the best show.

Hygienic Passenger Cars.

At the late meeting of the Association of Railway Surgeons, at Detroit, Dr. J. N. Hurtz took up the question of the spread of disease through the medium of plush seat coverings and the elaborate trimmings in the interior of a car. He would have plain hardwood floors, without any matting or carpets, but covered with rubber strips or rubber tile to prevent slipping. The crevices and joints which will catch dirt or disease germs should be eliminated as far as possible.

It is said that two extensive roads, the Chesapeake & Ohio and the Big Four, have decided that the doctor is right, and will build a few cars after his plan. Very likely the idea is also to see whether the general traveling public will agree that cars can be built on strictly sanitary plans and at the same time be comfortable and pleasant to ride in. The public look for comfort while traveling, and may not consider that sanitary arrangements to prevent the spread of disease should interfere with comfort.

We wish that the question of sanitary and comfortable ventilation could be easily solved, but it is a long way off from being satisfactory now. An attempt is made to ventilate the cars from the top, above the cloud of dust, but until the smoke and cinder nuisance is done away with, this will not be done; the greater part of the air will pass in and out of the car through the side windows. On a hot day the windows are put up as soon as a passenger takes possession of a seat—not the window that really ventilates that seat, which is the one just ahead of it, but the window beside that seat, through which the current of air blows on the next seat back. The dirt and cinders are as great a menace to health as any bacteria which may be lodged in the furnishings of the car.

It is a debatable question, with good arguments in favor, if it would not be a good plan to have the windows fastened so that the services of a trainman or porter would be necessary to raise them, just the same as for turning the seats, and have larger openings for air above the heads of the passengers, in the roof.

The control of the windows by the porter seems to work all right in Pullmans; they do not have one-tenth of the dust and cinders usually found in the day cars.

Some roads have the window so constructed that the sash will not raise over 6 inches. This gives a restricted opening for air and dust, as well as bringing the lower part of the sash on a line with the passenger's eye. In order to see the country outside clearly the sash must be lowered.

A good many of the uncomfortable arrangements in a car are there because the traveling public puts the railroad company on the defensive. Because some of the passengers monopolize four seats, to the exclusion of others who cannot find one vacant, the companies are forced to lock the seats and refuse to turn them, in order to give other patrons a fair chance.

The average American citizen likes to have a place to stretch out. With the seats all locked, it is impossible; the cramped position soon tires him out. Many patronize the chair cars for this reason.

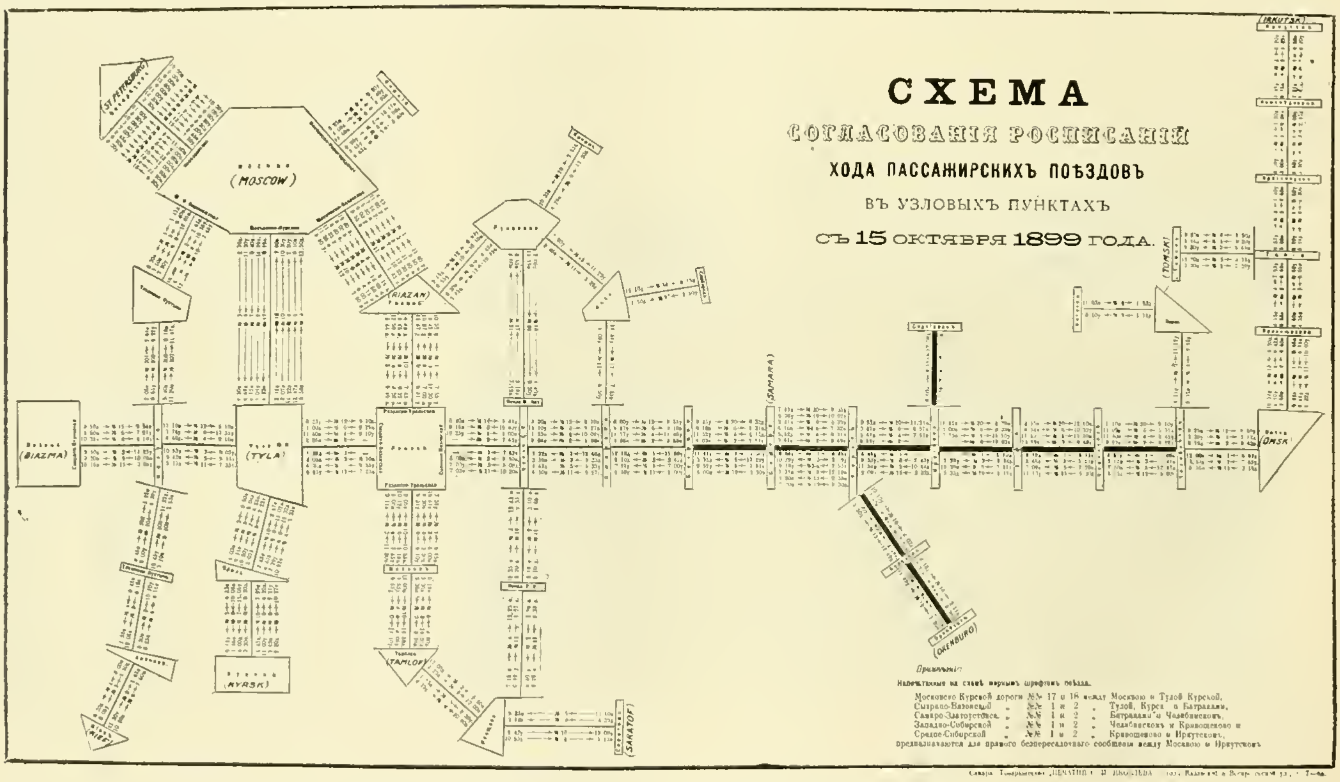
A Point Against Electric Railroads.

A few weeks ago a locomotive engineer who has seen long years of service on a road where making the time was the prime requisite of successful operation, was out on one of the electric lines that give suburban service to the small towns near a great city.

When the time came to return, he was promptly on hand and took his seat just as a thunder storm came up. There being no move made to start the car, he naturally inquired the reason, and was told that they could not run during a thunder storm. The lightning was striking the copper conductor wire and was liable to burn the motor out. While they lay there about an hour waiting for the storm to clear away he did some heavy thinking about the disadvantages of the electric trolley system as compared with a steam locomotive, which starts out with its train on schedule time, regardless of a rainstorm.

No amount of argument will ever convince that railroad man that electricity will ever supplant steam in handling railroad trains, at least while lightning can get into the trolley wires and interfere with the power supplied from the power-house.

Possibly this trouble will be worse in the country, where the road runs over the tops of hills, than in the cities, where the wires are below the level of the tops of high buildings.



A RUSSIAN GRAPHIC TIME-TABLE AND TANGENT-MAP COMBINED.

Extending from Peterburg to Ірkytck (Central Siberia), and covering some 20,000 verstas (12,000 miles) of track. See page 422.

General Correspondence.

All letters in this department must have name of author attached.

About Broken Glands.

On page 288, July number of Locomotive Engineering is an article on breaking studs on stuffing-box glands when metal packing is used. Somebody asks what can be done if stub is broken, and in the same article it suggests a disconnection in some cases when gland is broken when engine is running. Now, as I have had some experience on that break-down, as well as many others on the locomotive, I think I can throw a little light on the disabled gland to the benefit of readers of Locomotive Engineering, and this is the plan:

If stub and gland are both broken, take away the pieces, run engine on top or bottom quarter, cover your ports so steam will not trouble you while you work, draw the spring out to the crosshead, and if you have no hemp or soap-stone packing, take your bell cord and put a couple of coils of it in the stuffing box, twisting or plaiting it in a "hurry-up" way as well as you can; then twist some waste up as hard as you can and pack it in tightly, leaving some room in the box for your spring. While you are doing this, have your fireman get a piece of board, a little longer than the diameter of your cylinder and height of your steam chest, split it in two and chamfer out a notch the shape of your piston rod, about 1 inch on either side of the stick. Then take another piece of bell cord, tie it to the lower end of the two sticks, bring it around under the cylinder to the front end, back over the steam chest, and make it fast to the other end of your two sticks. Put a binding stick in on top of the steam chest or at the front end of the cylinder head, crosswise in your bell cord—that is, tied to the sticks—then turn your binder, bind it up as you would bind a load of wood, drawing your wooden gland and compressing the spring to clear the boss on your crosshead. Make the end of your binding stick fast to blower pipe or hand rail, and you are ready to go. This need not take over thirty minutes at the outside, and can be done in fifteen minutes.

A. J. O'Hara.

Port Jervis, N. Y.

About Firing.

In the August issue I saw an article, "We Must First Learn to Fire," which is a good thing. Mr. Cragin covered the whole ground about firing, but I am sorry there are not more like him.

A great many of our firemen do not study firing enough. They shovel in coal until the steam goes back, and then rake it until the engine gets hot; shovel again until steam goes back, and so on until in a few miles they have neither steam nor fire.

We have a tunnel on our road one mile long. It used to be so smoky, I dreaded coming to it. But they are re-arching it now, and the orders are very strict about smoke. The tunnel is almost clear of smoke now, and I think we have a little more steam than we used to have.

Another thing: Not long ago we had an officers' train over the road. I told my fireman to make all the black smoke he was going to make before we started or we might have trouble. By using care he did not make much smoke and did not get away with more than two-thirds of the coal he usually does. I will not say "burn," for I believe half or one-third of the coal is punched out with the rake, for want of timing with the shovel.

I hope no fireman will be angry and think I am not his friend, for the boys on this division can prove that I am.

Cumberland, Md. D. Linn.

MEXICAN CENTRAL ENGINE—RESERVOIRS OVER CYLINDERS. (KINDNESS OF N. BARRETT.)

How Much Oil Shall We Use?

This question seems to be still vexing the souls of railroad men from managers down, and is one on which there is as wide a difference of opinion as can be found on any subject. The engineer knows the result of too little lubrication in the annoyance from hot bearings, while the manager knows of the waste of oil beside the track and of the quantity that never reaches a bearing to do effective work.

I am sure that no manager will object to his men having all the oil they can possibly *use* in lubrication, as it is hard to realize a condition where bearings run with too much lubricant actually on them. In fact, if it were possible to run flooded bearings, as is done in high-speed stationary engines, the oil question would probably disappear.

There seems to be little doubt that a dollar's worth of oil actually used on a bearing will save several dollars in fuel and repairs, and the real economy of seeing how little oil can be used to get an engine over the road remains to be proven. The bearing may not heat beyond the running limit, but it would run easier if it had a better supply of lubricant.

Oil economy is a good thing, but let us be sure it is economy before we cut the allowance too fine *until we provide mechanically better bearings* and better appliances for applying the oil. For it is not economy to save 50 cents in oil and spend a dollar for coal and repairs, because some other road or some other engine only used so much oil per mile run.

With bearings in good shape, oil cups ditto, and an oil can that is worthy the name, I believe the oil consumption can be materially reduced on most roads. But as long as bearings are as they are, and oil cans besmear themselves and their users with precious drops of the anti-frictional balm, is it not better to use a little more oil, and save coal, repairs and profanity, as well as the attendant "grief" for all concerned?

In other words, the saving of oil should begin at the mechanical end of the question and produce bearings and appliances that will *use* rather than *waste* the oil. Beginning at the oil end doesn't produce as satisfactory results, although there is no doubt that much oil is wasted through ignorance or carelessness which might be saved without reference to the mechanical questions mentioned. It is a question to be looked at calmly from both sides, and which must be solved for the good of the service.

I. B. Rich.

Honeybrook, Pa.

Setting Up Wedges.

I have a way of setting up wedges which might be of benefit to others. Place your right hand crank pin on top forward eighth, cut out driving brakes and apply the tank brakes. Place your reverse lever in forward motion, giving engine a little steam, which will make your driving boxes rest solid against shoes; and block behind all driving wheels. Now begin with your main wedges and set them up as tight as you can get them, then measure your distance between pedestal brace and the bottom of your wedge and get a nut or any piece of small iron about 1/8 to 3-16 inch less than your measurement was, between the wedge and pedestal, governing yourself about this thickness according to amount of taper in the jaw of the frame. Place the nut or piece of iron between pedestal and bottom of wedge, then draw your wedge down firm on the nut or iron; tighten your keeper, and you will have a wedge set that will never stick or come down on the road, and you will very seldom have a broken wedge bolt, as it is the up-and-down motion of the wedge on a loose wedge bolt head that usually breaks the bolts and sticks the wedge.

J. M. Gailey.

Prescott, A. T.

Economy of Injectors.

We sometimes hear the question asked: Is an injector any cheaper to operate than a crosshead pump on a locomotive?

There are several points of economy in favor of the injector, which will possibly account for its universal adoption and the putting of pumps into the background.

First cost is one very important consideration. An injector costs much less than a pump to manufacture and apply to the engine; the piping is no more expensive, while the ease with which it can be taken off and another one put on saves labor when repairing defects or disabilities. Just how much a crosshead pump costs would be a hard matter to find out now, as there are so few of them in service.

The power that operates the pump comes from the boiler in the first place, the same as for the injector; but we do not utilize all the power in getting the work out of the steam through the medium of a piston moving in a cylinder. There are so many losses from leaks, condensation, faulty distribution of steam by the valve motion, internal friction, etc., that a considerable part of the power of the steam does not reach the crosshead. For injectors, the claim is made by those versed in the theory and practice of their operation that all the power of the steam used is turned either into motion or heat, and in that manner all the power gets back into the boiler, except what is used up by the friction of the water and steam passing through the pipes and the losses by radiation, which are not large.

The stream of water through an injector is continuous; that through a pump is intermittent, as it starts and stops with each stroke of the pump plunger. A continuous stream can be moved with less friction than one that is started and stopped every stroke.

Of course an injector can be so operated that it is wasteful of steam, but its principle of operation is so well known now that everyone can use it to advantage. It puts the water into the boiler at a higher temperature than a pump, so the flues should last longer.

The main advantage of the injector is: it can be operated at any time you have a supply of steam and water, whether the engine is running or standing still. This is worth all the rest put together.

These remarks are called out by hearing assertions made that the old crosshead water pump could be replaced on the engines as a measure of economy and comfort on the large engines now in service.

John W. Troy.

Indianapolis.

That Philadelphia & Reading Engine.

Whether Mr. Prince would design a complete new engine, with cylinders of the same dimensions as his rebuilt engine, No. 218, remains to be seen; but of one thing we are certain, the 21 x 22-inch cylinders are just the thing for a high-speed engine. If, as it is claimed, that 1 inch in diameter is equal to 2 in stroke, it certainly proves the short-stroke engine to be the best. The short stroke is easier balanced, so far as the reciprocating parts are concerned; she is easier on the guides and crosshead; there is less liability of pins heating and certainly less reason for side rods breaking. Notice the long-stroke engine in motion with the side and main rods flying through space; does it look natural or mechanical? and at high speed does it not cause an uncalled-for wear and tear on the moving parts? In my travels I have noticed some long-stroke heavy freight engines (compound and single expansion) on which over 50 per cent. of the repairs to the reciprocation can be accounted for by the long stroke and high speed while drifting down grade. In locomotive practice I believe we can get pointers from builders of marine and stationary engines, as in a great many cases in their high-speed engines the diameter is greater than the stroke. Did you ever notice that in increasing the size of a driver by putting on an additional tire, thereby making an unusually heavy rim, how much steadier the engine would run than under the old conditions? Short stroke, big diameter and heavy rims with properly designed valve motion are the factors in a steady-running high-speed locomotive. Yes, Mr. Prince is moving in the right direction, and no doubt but what the "218" will give a good account of herself.

W. De Sanno.

Kern, Cal.

The Friction of Steam and Gasses.

Many seem to overlook the fact that friction plays quite an important part in the area of steam ports and other passages, so that the results of experiments may be misleading.

A round hole gives the greatest area for a given amount of frictional surface, as can easily be proven, either graphically or by calculation. A hole 10 inches in diameter has a circumference of 31.416 inches and an area of 78.54 square inches, while a square hole with the same frictional surface would be 7.86 inches on a side and have an area of only 61.78 square inches.

The practical bearing of this is in the case of peculiar valves or exhaust nozzles, where the passages are of peculiar shape or consist of numerous openings. In the case of steam ports there is no question as to the necessity of allowing more area if the surface is materially increased, and with an exhaust it is also true that an apparent increase in area may only give the same effective opening as a smaller nozzle of the usual shape.

I was interested in the description of the Sweney nozzle in the September issue, as I always want to know what is new; but I cannot help thinking this is a case where the larger area is only apparent, and not actual.

It is possible the division of the exhaust into jets may be advantageous in some ways, but I cannot see that the effective area of the nozzle has been materially increased. The friction on the sides of the several jets must about balance the increase in calculated area. I'd like to have the company try one on some of the engines in this vicinity and watch it.

FRANK C. HUDSON.

Tombstone, Ariz.

Main Reservoirs—Truck Cellars—Steam Pipes and Front Ends

There has been considerable discussion in regard to making the locomotives so large that there is no room for the main reservoir, which is about correct as far as locating them in their regular position goes. I notice one suggestion for placing it in the pilot, but it seems to me that the best place is in the front end, occupying the room formerly taken by the extension front. As most master mechanics are discarding these, why not use about 24 inches of this for the main reservoir, in the form of a ring to allow getting at flues and pipes, which would give about 70,000 cubic inches, and also keep the air warm from the smokebox.

The use of air has led some engineers to suggest two air pumps, which might be a good thing in case one was disabled, but the main thing is to have the large main reservoir such as can be had in the front end, as mentioned before.

Engine truck cellars are reported for packing much oftener than the driving box cellars, and it seems to me the reason is that in the truck box we depend on the waste for lubrication, and when that wears away from the journals there is trouble. In the case of the driving box we oil from the top, and do not depend on the cellar entirely. Would it not be a good plan to oil the truck from the top in the same way?

In most front ends the bottom steam pipe connections do not seem to be located properly, and give lots of trouble from the heat of the front end causing unequal expansion and making the joints leak. How would it do to run the steam pipe outside the front end and have the joints near the steam chest, which would do away with considerable trouble in this respect? In the case of piston valve engines this would be very easy and will, I believe, be used later.

I see Turner's front end is illustrated once more. Well, it took them a long time to find out the extension front end was no good and only a nuisance and an obstruction to draft. I always did think that there was too much machinery in the front end; they got along years ago without it, and it won't be long until Turner's style of front end will be used universally.

They have a great deal of trouble sometimes with the copper gasket blowing out of exhaust nozzle at the joint, and the steam blows into the flues, interfering with draft and steaming qualities of the engine. This matter is very easily remedied. Why not bore the holes out in the exhaust nozzle and let them down over the lugs on the saddle and make the joint on the saddles instead of on the lugs? Then the steam would be past the joint when it struck the lugs, and could not blow the gasket out, the lugs protecting it.

In the August number someone asks for the best way of disconnecting the large engines of to-day. They are making the engines so large that it takes four men and a boy to lift a main rod, and as they are making the main rods now without straps, in this case you have to take it down, unless you are going to let your piston drag the cylinder. I would not do this unless I had an extended piston rod; then I would want it well oiled, otherwise I would not run a disabled side with the piston dragging further than 25 miles. Some engineers would not run an engine without disconnecting, but these same men will run an engine and let her drift 25 or 30 miles and never think of it. Some leave the throttle slightly open when they are drifting to set packing out, while others don't.

J. P. HAYES.

Chicago, Ill.

Water Circulation.

We hear considerable about engines not steaming freely because the boilers are so badly scaled up that the heat cannot get through to the water. There is no doubt that heat will not go through a scale of lime or other incrustation on the flues as quickly as through the iron flue, but I think there is another reason for the defect in making steam.

No boiler will steam freely unless the water can circulate through the water spaces fast enough to let the steam pass upward and at the same time have a supply of water constantly coming in to pass over the hot surfaces and be evaporated in its turn. This fact is very easily proved by noting the work of a boiler just after it has been thoroughly washed out, and later when the scales and soft mud have filled the spaces between the flues.

If boilers are carefully washed out to get the loose scales out that interfere with the free circulation of water up through the flues, the thin scale will not do as much to impede the free steaming of the boiler as is usually charged.

Most boilers have holes along the side and in the boiler head to get a stream of water across the crown sheet between the bars. In the case of a boiler with a dome over the firebox, it would be a good plan to put a heavy stream down on top of the crown sheet through the dome cap. Radial-stayed boilers do not give so much trouble here. To go back to the matter of scale being a non-conductor of heat, suppose you try this experiment: Take one of the long scales that comes off the outside of a flue and heat one end of it in a gas flame, holding the other end between your fingers till it gets too hot to hold. Then try a piece of iron of the same length and thickness as the scale. You will get a good idea of their relative heat-conducting powers.

I have noticed that the boilers with narrow water spaces between the firebox and outside shell do not steam as well as those with wider water spaces, which goes to prove that free circulation is what counts. Then the very narrow boxes that are so much wider at the crown sheet than at the grate, so the sides overhang at the top, do not give as free a circulation of water next the side sheet as the firebox that tapers the other way. This is easily seen when you compare the work of one of our locomotive boilers used in a stationary plant with a boiler with wide grate and narrow crown sheet, something after the style of the Colburn boiler

Design the boilers with liberal water spaces, so the steam can get up to the top after it is made, without holding the water away from the hot surfaces, and we will have better steamers.

JOHN S. CANADA.

Bloomington, Ill.

A Good Record.

The method of piping the exhaust of the air pump shown by Mr. Schaefer in the August issue certainly gives good results in his case at least. The following letter shows the mileage made by one of his Baldwin compounds over a very hilly road, the Central New England:

"Referring to our conversation of a few days ago, and my letter of May 3, 1900, regarding our compound engine No. 4, I wish to say that when I wrote you, at the above date, the engine had made a total mileage of 67,656. Since that time she has made, in May, 4,491 miles; in June, 4,511; in July, 4,752; and in August, 1,500 miles. We have renewed the packing rings in both main valves, as they were getting too loose in cylinders and too loose in groove.

This is a total mileage of 82,910, without touching the cylinders or valves of this engine; and I wish to say that the valve packing rings removed were as smooth as a piece of glass. HUGO SCHAEFER,
"Hartford, Conn. M. M."

About Oiling.

We find considerable trouble on the large engines by the cylinders being cut so badly that they must be bored out after less than a year's service; in many instances they are bushed with a harder kind of iron.

In a good many cases the metal seems to cut away faster at the top of the cylinder than at the bottom. One would suppose that the cylinder would wear faster at the bottom than at the top, as the piston drags back and forth. Certainly the weight of the packing rings rests on the bottom.

Now, is not this trouble caused by the valve using all of the supply of oil fed from the lubricator, so that the piston does not get any? The valve is very much larger to-day than a few years ago, both on account of the increased length of steam port and increased travel of valve. The supply of valve oil, on the other hand, is steadily dropping down year after year, till we do not have over four drops a minute for a valve, its seat and the cylinder.

The oil which now starts towards the cylinder has to go down through the steam port after passing over the surfaces of the valve. Any that does not get through to the cylinder before the edge of the valve cuts off the steam probably lies in the steam port and is sent out with the exhaust steam and does the cylinder no good at all.

How would it do to lubricate the piston and cylinder directly—that is, have an oil-pipe connection to the middle of the cylinder, near the top, so the oil would feed in there and oil the piston each time it passed the opening? There could be no hold-up of the oil, for as soon as the pressure in the cylinder was less than in the oil pipe from the lubricator, it would feed through.

This may be rank heresy to suggest that a device be put on that would increase the number of places to feed oil into, but it raises a row when you tell the locomotive builder that he puts a poor article of iron in the cylinders, so that they wear out before their time. P. C. ZINFANDEL.
Scranton, Pa.

Cleaning Engines.

During the past few years it has been demonstrated beyond a doubt that the pooling of engines is a profitable scheme and that it has come to stay. There is still a prejudice among the firemen, caused by being compelled to go back to the roundhouse after having eight or ten hours' rest to do two or three hours' cleaning.

Quite often just about the time you get some engine cleaned you are called to go out on another. You hurry over with your clothes and climb aboard the one marked up, and this is often what you meet with: First, there are coal and cinders, 2 or 3 inches deep, on the deck; great clouds of sulphurous smoke issuing through the firedoor, one lamp with broken globe, no broom, an old, battered bucket without a bail, but with a hole in the bottom; a seat-box that would not hold corn on the cob, let alone keeping the dust and dirt from your clothes; a window-glass broken on the left side, that you might enjoy the full benefit of a refreshing shower bath when it rained; an arm-rest with a piece of rubber hose for a cushion, a bell-cord half wornout from being pulled through a staple where a pulley should be, one marker that had recently been burned up and two flags without staffs. You may even find a leaky blow-off cock beneath you, and a leaky valve or two on the boiler head to keep the air warm and moist in the cab. On the other side sits an engineer who is duty-bound to make time, an oil record and pull first rating.

Is there anything here to encourage a man to clean on the road or in the roundhouse until compelled to do so, and then only to hold his job? Under such disadvantages a man cannot carry decent clothes or wear clean ones.

When the change was made from regular to pooled engines, the engineer's machinery and other work was eliminated from his duties. They hired machinists and machinists' helpers to do what the engineers had done before. In the same way the engines should be cleaned for the firemen. If not why not?
St. Joseph, Mo. X. T. CRAGUN.

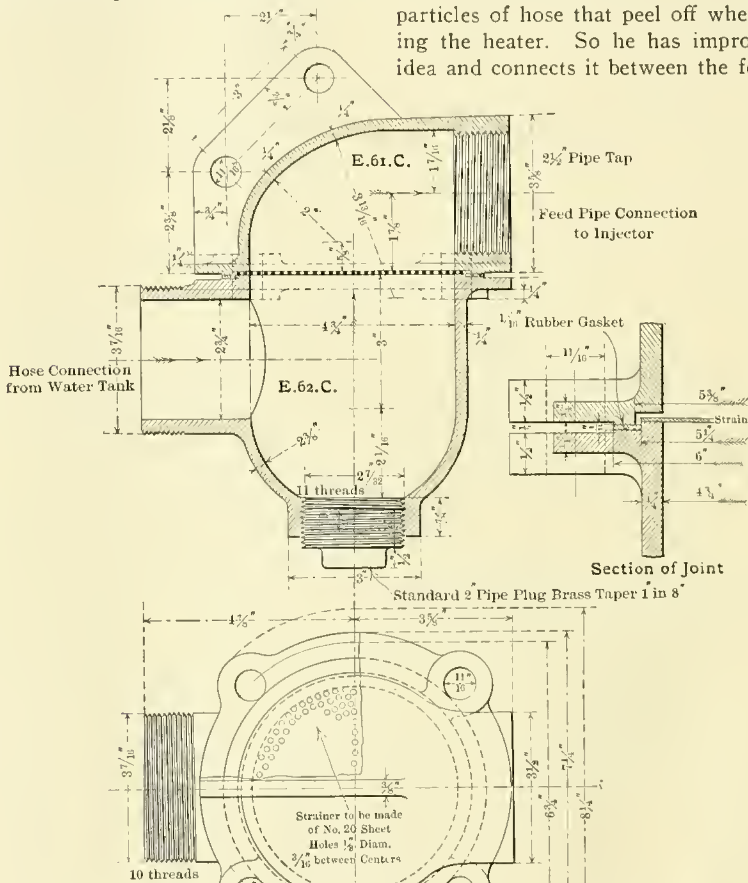
A New Injector Strainer.

In November last we illustrated a tank strainer designed by J. P. Hays, of the Burlington Route, which seemed to be a particularly good idea.

He found that it was too heavy, and that, being on the tank, it did not stop the particles of hose that peel off when working the heater. So he has improved the idea and connects it between the feed pipe and hose, so as to catch all that comes along. The cut was made from a blue-print kindly furnished by Mr. F. A. Delano, as it shows what is now the standard strainer on the Burlington lines, and we understand the Denver & Rio Grande are also using it.

It is fastened up by the lug shown, and the operation needs no explanation as details are clearly shown.

The area of openings in strainer is an excess of 40 per cent. over the feed pipe area, but this could be readily enlarged if found desirable. The cleaning plug below gives a good opening, and there is no reason why this should not give good satisfaction. It is patented, and is being manufactured by the Western Supply Company, of St. Louis, Mo.



HAYS INJECTOR STRAINER.

Consumption of Steam by Injector.

Through one of the slips that occur all too often in any business, we made a misstatement in the September issue in regard to the steam used by an injector, and we are glad to be called to account by such an able authority as Mr. Kneass, who says:

"While I was glancing over your interesting paper—which I always do as soon as it comes to hand—I noticed on page 406 a little paragraph on the consumption of steam by an injector, which I am sorry to say is incorrect.

"An injector feeding 3,000 gallons, or 24,990 pounds of water per hour, and delivering 13 pounds of water per pound of steam, must use 1,922 pounds of steam per hour (instead of 230 as stated). At the usually accepted water rate of 30 pounds per horse-power per hour, this corresponds to 64 horse-power (instead of 1 horse-power).

"This represents the amount of steam taken away from the cylinders by the injector; but with the injector your paper refers to, where the ratio of water to steam is 9.69 to 1, the equivalent horse-power is 86, which is about 33 per cent. greater than is used by the injector where the ratio is 1 to 13, delivering water to the boiler at a lower temperature.

"STRICKLAND L. KNEASS.

"Philadelphia, Pa."

Selling Jimmy Jones a Catalogue.

Jimmy Jones was the meanest man on the road, as far as money went, and if he isn't rich some day it won't be because he spends anything. The other day Sellers sent a number of their little "Injector Handbooks," by Strickland Kneass, to the master mechanic, and Billy Waters, his clerk took them in charge. Billy knew Jones' weakness and started in to have some fun with him. Taking a few books in his pocket, he started out to find Jimmy, and ran across him in the roundhouse.

"Got just the book you want, Jimmy. Tells all about injectors, and you know you were asking Johnson about them yesterday. Only costs a quarter."

"I'd like one, Billy—I would, by jinks! Just what I want. But say, Billy, I'll tell you what you do. You give me this one and I'll crack it up to the boys, so you can sell lots of 'em. Can't you let me have that one?"

"Give it to you for 15 cents, Jimmy—if you'll help me. They cost me 10," and Billy told it just as straight as though it was true.

"Oh, come, give it to me—that's a good boy—I'll help you lots." But Billy was obdurate, and finally offered it for 10 and then 5 cents, and on conditions of absolute secrecy and assistance gave him one.

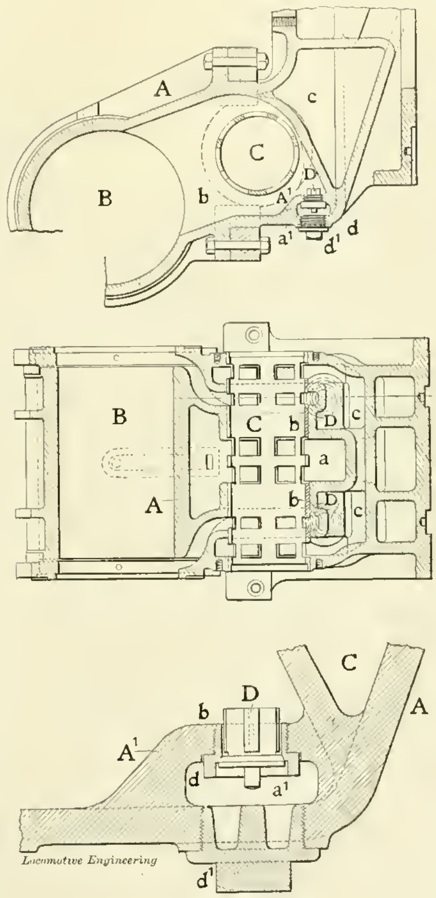
When Jimmie tried to "crack it up" to the other boys they only laughed and showed theirs, for they had heard of Billy's little joke. Now Jimmy Jones has it in for Billy Waters and is waiting to get even.

Relief Mechanism for Piston Valves.

A patent has been granted to Mr. G. R. Henderson, assistant superintendent of motive power and machinery on the Chicago & Northwestern road, for a method of relieving piston valve locomotives of excess counter or water pressure.

The illustrations make the device quite clear, and there is no question as to its utility in this connection. In reply to an inquiry, Mr. Henderson says:

"As is well known, the ordinary slide valve in a locomotive will lift with an ex-



RELIEF MECHANISM FOR PISTON VALVES.

cess counter pressure and allow the water or pressure to relieve this between the face of the valve and the seat. Piston valves cannot so relieve themselves, as they practically fill the chamber, and there is no part that can give way under the pressure in order to prevent doing damage to the cylinder head from counter pressure, etc. My patent constitutes the use of a valve which is located between the central steam passage or chamber of the cylinder and port, closing by excess pressure in the steam passage. As this always has greater pressure than the cylinder, the valve is always closed, but if from over pressure or water there is excess pressure in the cylinder this valve will be forced open against the general steam pressure, thus giving immediate relief to the counter pressure in the cylinder.

"In operating with the throttle closed the valve drops down by gravity, thus allowing a circulation between the two ends of the cylinder and acting in a great measure as a relief valve on two-cylinder compound engines."

American Locomotives in Egypt.

The following extract from the report of Lord Cromer, Consul General in Egypt, is interesting not only to American builders of locomotives, but to all who like to see a man fair enough to drop personal feelings and judge according to the merits of the case:

"I am glad to say that the only locomotives recently supplied by an English firm —Messrs. Neilson Reid & Co., of Glasgow —have not given the slightest trouble. Those purchased from America in 1898 have also done well; but, as they differ in many respects from our standard types, our men have taken some time to learn their peculiarities, and we have not been able to get the best results out of them. The action of the board in ordering locomotives and wagons from America has been criticised. It is due simply to the fact that American firms, while they are not in a position to tender on more favorable terms than others on our designs, almost invariably offer us engines or wagons built to standard designs of their own at lower prices and in less time, while English and other European makers content themselves with tendering on our designs, being, as a rule, not in the habit of manufacturing to standard designs of their own. We much prefer adhering to our own standards; but in cases where time and cost are of great importance, such an offer from America cannot be passed by."

Something About Indicator Cards.

An inquiry from an apprentice in regard to the cards shown by Mr. Wildin in the July issue, prompts a little talk on indicator cards in general.

As Prof. Cecil H. Peabody so aptly remarks in his book on the subject: "The sole object of the indicator is to measure and record pressure; actions which are commonly said to be revealed by the indicator are really inferences based on the pressure or on changes of the pressure." Remembering this will help us to avoid the mistakes too many have made of considering an indicator as positive proof of certain conditions, when in reality the wrong inference was drawn without considering all factors entering into the case.

The different points of the card are marked on the upper figure, and the easiest way to "read" the other cards, or to try and find out all we can from them is to compare the cards.

The expansion of steam is supposed to follow what is known as Mariotte's or Boyle's law that the volume increases just in proportion as the pressure decreases. If a cubic foot of steam at 100 pounds pressure is allowed to expand into double the space (or 2 cubic feet), the pressure falls to one-half, or 50 pounds. This is what is meant by "inverse ratio," which used to puzzle most of us and make us wonder why the books on expansion didn't talk English. Just call "inverse" "opposite" and there'll be no trouble, for the pressure varies just opposite from the volume—four times the volume gives one-fourth the pressure, etc.

Taking the upper card and finding the point where piston starts to move and the steam line is even, indicating that the port is open wide till nearly cut-off. As it begins to close, the pressure drops down and rounds the corner on the card until cut-off takes place, as shown. As a matter of fact, the exact point of cut-off is usually a mystery on a link-motion card, but we can guess near enough for all practical purposes.

After the valve closes, the pressure drops as the steam expands and gives the "expansion line" on the diagram. If steam was a perfect gas and nothing else interfered, this line would be a perfect curve—called hyperbolic—which would indicate at all points that the pressure and volume varied exactly as before stated. But it doesn't, and we use this curve just as a guide to see how near it comes to it.

When the exhaust opens at about the point shown, the pressure drops faster; but being at a low pressure anyhow, the drop is not as sudden as might be expected.

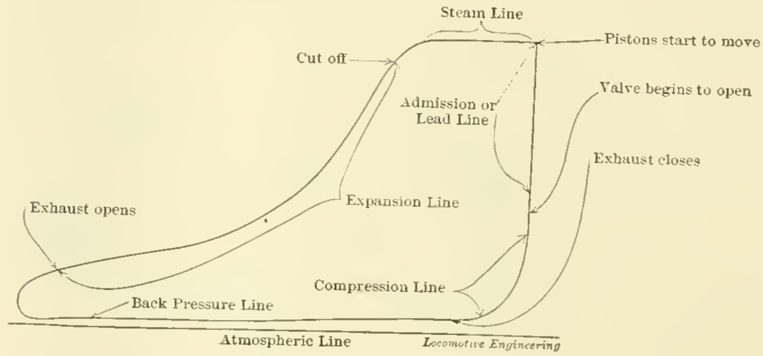
When the piston starts back, the expanded steam must get out of its way, and the pushing out of this cylinderful of exhaust steam causes a back pressure, or pressure in opposition to the piston's movement, as seen in diagram. The distance between this and the atmospheric line, or line of no pressure (except that of the atmosphere) shows the amount of back pressure.

It is probably known by all that the height of a card depends on the spring used. A 100 spring means one that will allow the pencil to be moved 1 inch in height for every 100 pounds of steam pressure. So with a 100 spring, if the distance between the back pressure and atmospheric lines is one-tenth of an inch, the back pressure is one-tenth of 100, or 10 pounds. This amount is seldom found in practice, except in very high speeds.

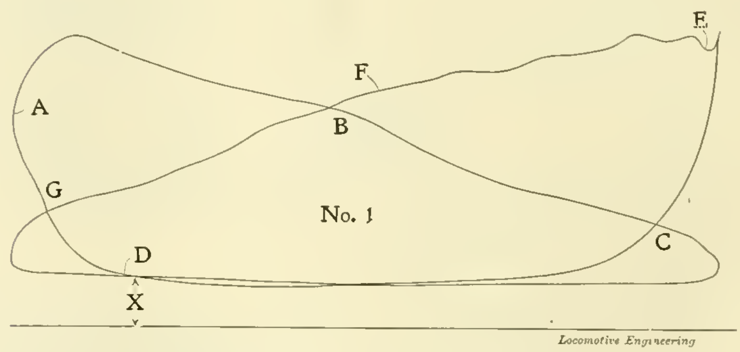
As the piston nears the end of the return stroke, the exhaust closes and the remaining steam is compressed between the end of cylinder and the piston. This, of course, increases the pressure, as shown by the "compression line" in the cut. The point where "valve begins to open" is not always clear, but as we know that practically all valves have some lead when hooked up, if not in full gear, we naturally look for the increase of pressure due to this, as shown by a straight or nearly straight vertical line at the end of the card.

Having followed the indicator pencil from the start back to the finish, we can begin to compare this card, which is pretty near an ideal one, with two of those shown by Mr. Wildin. These represent a case of "before" and "after" taking their tonic in the shape of a resetting of the valves, which seems to have been needed.

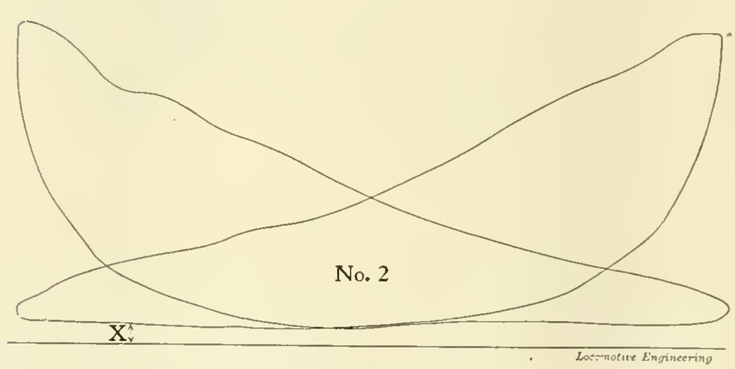
Taking No. 1, the valve appears to have admitted steam at A, or a trifle below it, after the piston had started to move. The valve opening seems to have been so slow that the piston had traveled quite a little distance before the steam pressure reached its highest point, and the valve evidently began to close almost immediately, as the pressure falls off quite rapidly. The point of cut-off might be taken at B, as the drop in pressure is a little more pronounced, but the exact point is "mighty unsartain." From here to C the expansion line seems quite good, and the exhaust presumably opens about this point. The back pressure



IDEAL INDICATOR CARD.



AN EXAMPLE OF POOR VALVE SETTING.



A GOOD CARD FROM ACTUAL PRACTICE.

runs to D, and X shows the distance between it and the atmospheric line. The exhaust closes about D, and compression continues almost up to A, which completes the cycle.

The card from the other end of cylinder is so different as to be an almost sure indication of the valves not being right; for it can be said, as a general rule, that when both ends of a cylinder show practically the same card, the valves are not far out. The cards may not be good, owing to faults in design of valve motion, but the indications are that the setting is about as good as can be expected.

The little drop in the steam line seems to show that the compression was carried to the right-hand point, and the steam entering as the valve began to open, was wire-drawn, so that it was of a lower pressure than the amount of compression. This is soon remedied by the valve opening wider and steam line is maintained a little better than in the other card. The waving steam line is not always easy to explain, but is often ue to the vibration or "dancing" of the indicator mechanism. It does not, however, affect the result. Calling cut-off at about F and exhaust opening at G, we have about the conditions of the other end, and there is little to be said.

Diagram No. 2 approaches the ideal in all except the steam line, which drops off much more rapidly than in the other case, owing to shorter cut-off. This, of course, gives a smaller movement of valve and less port opening. Compression, too, is heavy when compared with the first diagram. These cards are very good ones, approximately alike for both ends of cylinder and as good as are often found.

Although link-motion cards are not ideal in either the steam or compression lines, it must not be thought that it is easy to improve this well-known type of valve motion. We have diagrams taken from an engine fitted with a cut-off valve, which are about ideal, yet in actual service the results were no better than the other engines, and the cut-off has been discarded. The heavy compression is needed at high speeds, and this is just when it occurs, as it increases as the cut-off is shortened. In fact, the link motion seems to be splendidly adapted to locomotive service, and although a better all-around motion may be invented, it has not arrived as yet.

Catalogue No. 34 has just been issued by the Newton Machine Tool Works, Inc., Philadelphia. It contains nearly 200 standard 6 x 9-inch pages and shows a variety of tools which will astonish those not familiar with their work. There are numerous varieties of milling machines, about fifty styles being shown, while the cutting-off machines also count up to good round numbers. Boring mills, mostly horizontal, automatic drilling machines, slotters, gear and worm-wheel cutters and nut-finishing tools about complete the list. The portable tools must not be forgotten, for they have made a specialty of this work and have developed many ingenious machines in this line, some of which have been illustrated in our columns from time to time.

CASTLE CRAGS FROM SACRAMENTO RIVER, ALONG THE SUNSET ROUTE.

American Built Locomotives.

Reasonable report states that the locomotive works of the United States last year turned out 2,196 locomotives, valued at about $23,000,000. Of the total number, 480 were sent abroad. About 30 per cent. of those sent out of the country went to Mexico and Central and South America.

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Utility of High Pressure Steam.

The degree of pressure at which steam is admitted into the cylinder of a steam engine exercises a direct and important bearing upon the economical working of the engine. American engineers have always been noted for employing high tension steam, and this feature of our engineering practice has done much to develop the peculiarities of the American type of steam engine. When Watt and his contemporaries in Britain were operating their ponderous engines with pressures seldom more than 10 pounds above the atmosphere, Oliver Evans and other early American engineers were using steam of 100 pounds pressure, and upwards, to the square inch. As a result, the small non-condensing engines developed certain powers with one-tenth of the weight of machinery used abroad, and compared favorably in point of economy with the elaborate and expensive engines that found favor and patronage in other countries. The force of numbers in following a bad example led many of our engineers to adopt the European practice of low steam pressure, but it was a move in the wrong direction which all those interested had to pay for.

Those who have been able to note the rise in steam pressures from about two atmospheres or under to from ten to fourteen atmospheres, as common working pressures, are well aware that the change has effected enormous saving in fuel. When 10 pounds above the atmosphere was the steam pressure ordinarily employed, each horse-power developed by the engine would require the consumption of 15 pounds or more of good coal per hour. Work was done so expensively under these conditions that the use of steam in transportation was seriously curtailed. Had no material change taken place, millions of acres of land in the States remote from the seaboard, that are now producing wheat and corn and give comfortable homes to prosperous settlers, must have remained a wilderness; for the cost of transportation would have rendered the produce of no value to the producer. Increase of steam pressure, combined with other mechanical improvements, has changed all this. The plain slide-valve engines employing steam of 100 pounds gage pressure now used in many factories, do their work with a coal consumption of about 5 pounds per horse-power per hour. Superior types of engines will produce much better results. A considerable share of this saving is due to improvement in mechanism, but the greater proportion results from the use of high pressure steam.

Using steam of high pressure is economical for several reasons. In the first place, steam of high pressure admits of a wide range of expansion. Examples have already been given of the increase of work that may be obtained from a given volume of steam by using it expansively. Every pound of increased tension augments the value of the steam as a medium of doing work, and one of the most urgent themes among officers responsible for the economical operation of railroads is that of having the potential power of the high pressure steam confined by he strong boilers converted into the work of turning a locomotive's driving wheels, instead of being reduced and its force wasted by passing through a restricted throttle opening. The quantity of heat expended in raising steam to a tension of 150 pounds is very little more than that required to evaporate the water at atmospheric pressure; yet this high tension makes a wonderful addition to the capacity of steam for doing work in an ordinary cylinder. As has already been explained, it takes 1,146 heat-units to convert 1 pound of water into steam at atmospheric pressure. The expenditure of 47 more heat units raises the steam to a pressure of 150 pounds. Heat is the source from which all the power of steam is derived, and if the steam engine was a perfect means of converting heat into work, the small quantity of heat employed to raise the tension of steam from gage zero to 150 pounds would be proportionally of the same value as the heat first applied to the water. But with the imperfect steam engine at the service of the industrial world, the first 1,146 heat units would practically be worthless for motive-power purposes, at least with non-condensing engines. The heat units added to make up a good working pressure of steam constitute the active element in the boiler, and provide the means of converting heat into work.

A second advantage gained by using steam of high pressure is, that the proportion of the heat expended in overcoming external resistance is small compared to the total heat units expended.

A third advantage is that the proportion of back pressure in the cylinder that uses high pressed steam is smaller than is practicable with a cylinder using low-pressure steam. There is always more or less steam in the cylinder that fails to escape when the exhaust port is opened, and it obstructs the piston during the return stroke. The amount of back pressure is not materially affected by the initial pressure of steam. With high initial pressure the obstruction of back pressure is not likely to seriously affect the efficiency of an ordinary engine; but with low initial pressure the case is different, and a large proportion of the work done by the steam on one side of the piston may be expended in expelling the steam on the exhaust side.

Although the advantages of using steam of high pressure are manifold, the practice entails a few drawbacks. The temperature of the boiler being high corresponding to the steam tension, the gases of combustion must pass out at a relatively high temperature, carrying away heat that might be retained in a boiler furnishing low-pressure steam. The boiler that furnishes steam of a high pressure must be stronger and better made than one that is intended for carrying light pressure. There is considerably more friction to the rubbing surfaces of an engine operated with high-pressure steam than with that of low pressure. When the steam pressure carried on British locomotives was under 100 pounds, they were run without any cylinder lubrication, and there was very little cutting of rubbing surfaces; but steam of 140 pounds cannot be used without the means of oiling valves and pistons. Even with good means of supplying lubricants, there appears to be a high percentage of the power of engines using high-pressure steam absorbed in overcoming internal resistances.

Dimensions of Flue Tubes.

The discussion concerning the best length of boiler tubes which took place at the last Master Mechanics' convention proved how little the engineering world knows positively about certain things that ought to have been settled beyond peradventure long ago. It is more than a century ago since Nathan Read, a native of New England, introduced a tubular boiler, but it received little attention until the necessity for rapid steam making became recognized in connection with the boiler of the locomotive engine. Peter Cooper, of Baltimore, recognized this requirement when he made his "Tom Thumb," the first locomotive run on the Baltimore & Ohio, and George Stephenson attained success and celebrity when he used a multitubular boiler in the construction of the "Rocket," which was really the first high-speed locomotive worthy of mention. Before the competitive test of locomotives took place on the Liverpool & Manchester Railway in which the "Rocket" came out victorious, a speed of 10 miles an hour was all that the engineers of those days expected to attain. Very soon after the competing trials the "Rocket" undoubtedly attained a speed of 35 miles an hour. This was made possible by the great steam generating capacity of a multitubular boiler. Previous to this locomotive boilers like those used for stationary engine purposes had one or two large flues, which gave a very contracted heating surface.

After the Cooper and Stephenson experience with small tubes that nearly filled the water space, there was very little effort made to keep the big flue in use. It disappeared for new work within a year or two after the small size demonstrated its superior efficiency and utility. It was easily proved that a small tube was superior to a large one in rapid steam making and in the extracting of more heat from the fuel gases, but the perfection of knowledge concerning different sizes of tubes was still in its infancy. Experience by degrees proved that the proper diameter of a tube was the smallest possible consistent with its not getting choked up by cinders; the best length has never been determined. The pioneer locomotives in this country and in Europe had very short tubes—so short indeed that it was a common sight to see the smokebox and smokestack red hot from the gases passing out of the tubes at an igniting temperature. This was gradually remedied. The tubes were stretched by degrees beyond the limit of utility, but after a time engineers settled down to about 12 feet as the proper length. A shorter tube is likely to permit the fuel gases to escape at an extravagantly high temperature, but the likelihood is that those who extend the tubes much beyond 12 feet will meet with the same experience that their predecessors did when searching for the economical limit.

There have been curious fluctuations of sentiment among American railway master mechanics and engineers about the value of a tube as heating surface. At one time a leading master mechanic became convinced that the tubes were of little value as heating surface, and as an experiment he plugged about 25 per cent. of the tubes of a certain engine without letting the engineer know anything about it. After a few trips the engineer was asked if he had noticed any change in the steaming of the engine lately, and he said no. That was sufficient to inaugurate a new fashion for a time, and a great many locomotives were built with very small tube surface, but that fallacy did not have a prolonged hold, and designers gradually returned to their senses.

The teaching of experience may always be depended upon to root out fallacies and to vanquish theories that are not based on sound practice. There is no good reason that we can see for making tubes 3 or 4 feet longer to-day than what was found productive of best results thirty years ago; but experience will prove in a few years whether or not the designers of the present generation are wiser than their fathers. There is a fashion reigning to build locomotives with "the largest heating surface yet provided," and that sentiment may have something to do with the favor that abnormally long tubes are enjoying. It would be a good thing if some of our enterprising master mechanics would specify one engine to have tubes, say, 15 feet long, while others of similar dimensions had tubes 2 feet shorter. An experiment of that character would be likely to show whether or not the movement towards longer flues was founded on sound engineering principles and likely to become permanent.

Compounds and Light Loads.

The general verdict in regard to the compound locomotive seems to be that they are economical at full load, but that the economy is much less with a light train, and that often a simple engine can equal it under these conditions. It is also sometimes charged that very high speeds are difficult to obtain, as the engine is logy after a certain speed is reached. That there are notable exceptions to this it is not necessary to state, but the charge is often made nevertheless.

While such criticisms are often the result of prejudice, there is a foundation in fact, as will be seen if we study the case carefully, and it is not to be wondered at that it is so.

After the Webb engine had run for some time on the Pennsylvania road a separate reverse lever for the high-pressure cylinders was put in, which gave a good chance to do some experimenting, and as the engineer was an energetic and intelligent man he gladly accepted a suggestion to note the effects of different methods of operation. He tried varying the cut-off on both high and low-pressure cylinders, and found that the best work was obtained with the high pressure cutting off at half stroke, and the low at about 20 inches out of 24, or five-sixths. With very light trains the low could be reduced to 18 inches, or three-quarter stroke, to advantage, but the high must remain at about half in any case.

The experience with the big Pennsylvania compound No. 1515 bears this out in a way, though in this engine both high and low-pressure cylinders are controlled by one reverse lever. But the enginemen find that it makes very little difference in fuel, whether they have seven cars or double that number. This shows that the heavy load is much more economical, which is to be expected; but it also shows that the engine is not well adapted for light trains as well—or, in other words, is not "flexible" for use in different kinds of service.

Indications seem to point to the high-pressure cylinder as the cause of this, for as the cut-off is shortened in the high, the compression increases, receiver pressure goes up, and that results are not entirely satisfactory is shown by the results on the 1515, before mentioned. All of which must not be taken to mean that the compound is not successful, but as pointing out the way to make it even more so.

Suppose we put a valve gear on the high-pressure cylinder that will give a short cut-off without excessive compression, leaving the low-pressure side as it is. This can be done by the use of the Myers, or any other equally efficient and simple, cut-off, and the high-pressure cylinder can be cut off according to weight of train, and still not have the "choking" or resistance due to excessive compression.

The case is different from a simple engine in two ways. There the exhaust goes directly out the stack and does not bank up in a receiver, and there is also more necessity for the sharper blast on the fire.

With a cut-off on the high-pressure cylinder as mentioned there is every reason to believe that a compound would handle light trains to better advantage, and that for very fast running it would have less difficulty than is now experienced at times. We believe there is enough merit in this to warrant a thorough trial, and hope to record the performance of an engine so equipped at no very distant date.

Relieve the Fireman.

A correspondent quite sensibly inquires why the fireman should not be relieved of cleaning and scouring and be privileged to get off his engine at the end of the trip, the same as the engineer. The question is opportune and important, and in justice to the fireman should receive careful, and even favorable, consideration.

A number of roads have already relieved the fireman of cleaning duties; but there are still others which allow the cost of cleaners to stand in the way, and consequently the fireman is obliged to "rub up" at the end of each trip.

For a number of years past there has been in successful operation on the Nashville, Chattanooga & St. Louis Railway a practice whereby the engineer and fireman, at the completion of the trip, step off their engine in the yard and turn her over to the hostler. If there is any work to be done on the engine, the report is handed by the engineer to the hostler. The engineer and fireman are not allowed in the roundhouse. They do not see the engine again until she is delivered to them in the yard, cleaned and ready for the trip. The engineer oils around, while the fireman gets up his fire, and they are off. This scheme was evolved by General Manager J. W. Thomas, Jr., who has been through the mill from the machinist apprentice, section hand, fireman and brakeman up to his present high position; and the success of the scheme should recommend it to others, who, upon trying it, will find it practicable and be sure to adopt it, thereby relieving the fireman of quite a heavy load.

The fireman's lot is not an easy one. He stands on his feet the greater part of his time. During a trip he must place with exactness several tons of coal over a large grate surface, a single shovelful at a time, lest he make too much smoke or too little steam. His arms, legs and back ache from the hard work, stooping position and swaying of the engine. He is usually young and husky—perhaps recruited from the shop or farm, and able to do a horse's work. Like the horse, he will plod as long as he is driven; but he can't last forever, and should be favored when possible.

We know whereof we write; for it requires no effort to look back to the time when we stood in the shoes of the individual whom we would now relieve. The incidents are so indelibly impressed upon our mind that we shall not soon forget the four or five hours' cleaning which invariably followed the road trip; how we were wont to lie down on the seat box for a few hours' sleep after the summer night's run, in order that we might begin scouring at dawn and have the cool hours of the morning in which to work; nor the anguish which possessed us when our gleaming beauty became tarnished from the dripping Pan Handle tunnels, Pittsburgh smut, careless hostler or "grumpy" engineer. How thankful we would have been had this sweating, sweltering, everlasting rubbing, hand-burning, acid-eaten finger nail experience been turned over to some other fellow!

While we were working, the engineer would "putter around," incidentally watching our cleaning process out of the corner of his eye. He smoked tobies and talked with the roundhouse foreman. He would sometimes set out the packing or superintend the work. He would also file brasses, clean the headlight, set up wedges and pack the valve stems and piston rods. He has since been relieved of all this work, and now merely goes down to the engine when called, fills the cups, oils around, and drives the heavy "battleship" of an engine over the hilly road as fast as she will go, while another fireman—a fellow with legs and arms as strong as freight-car axles and a back as stiff as a double bar frame—stands up the entire distance and uses one shovelful of coal at a fire. May he mercifully be given his rest at the end of the run. He earns it: for the train is much heavier; his engine weighs nearly twice as much as ours did; he fires nearly double the amount of coal we did, and furnishes steam for a cylinder whose volume at each stroke is nearly twice as large as ours. May he have to do no cleaning.

The engineer has been relieved of all repair work on the engine, and is strictly a road man, and not at all a shop man. Why not, then, extend this same consideration to the fireman—relieve him of his wiper's and cleaner's duties, and make it a thoroughly road crew?

Wide Fireboxes and Exhaust Nozzles.

In a recent issue of the *Railroad Gazette*, Mr. J. Snowden Bell, probably the most persistent advocate of the so-called Wootten type of boiler in America, closes a plea for the wide firebox in the following manner:

"Anyone who observes a narrow firebox engine, spending a large part of its power in pushing the steam out of the cylinders in order to overwork an insufficient grate area, ought to be persuaded of the substantial advantage of the wide firebox."

There is but one construction to put on this. If the narrow firebox engine uses more of its power to push the steam out of the cylinders it is on account of smaller exhaust nozzles, presumably necessary to force the fire harder than in the wide firebox.

It would seem reasonable that as the smaller grate area burns more coal per square foot per hour than the other, it should require a stronger blast, and this being the case, we would expect to find wide firebox engines with much larger nozzles than those with small grate area, much larger when the difference in grate is considered. But let us see what we find in practice.

The Philadelphia & Reading engines with 18½-inch cylinders have 4¼-inch single nozzles, while the 21-inch engines have a 5-inch nozzle—also single. This with a grate area of about 76 square feet.

The narrow firebox "L" engines of the Pennsylvania, with a 19½ x 26-inch cylinder and a grate of say 33 square feet use nozzles from 4¾ to 5¼-inches.

This hardly bears out the statement that narrow firebox engines are handicapped by their exhaust, as it all goes through the exhaust nozzles without having time to look back through the flues to note the width of the firebox. For fear this might be called an exceptional instance we have jotted down a few examples from recent practice giving size of cylinders, grate area and size of exhaust nozzles as follows:

Cylinders.	Grate Area.	Nozzle.	
20 x 24	84 square feet.	4¾	Single.
	31 " "	5½	"
20 x 24	80 " "	3⅜	Double.
	32 " "	3½	"
19 x 24	80 " "	3⅜	Double.
	26 " "	3½	"
21 x 26	82 " "	3½	Double.
	32 " "	5½	Single.

This would seem to be a case where the theory of Mr. Bell and actual practice are out of joint, but after you look at it there isn't much to be wondered at. With a given vacuum in the front end the action on the grate will be about in proportion to the area, and while this narrow box burns more per square foot the total amount is no larger than with the large grate. In other words the action of the exhaust on a grate of 30 square feet will be more intense per square foot than in a box of 90 square feet, but the total must be approximately the same in either case; at least so it would seem from actual practice, as shown by the figures given.

Considering the facts concerning the size of exhaust nozzles for both style of fireboxes, it certainly takes a vivid imagination to observe the difference between the narrow firebox engine "spending a large part of its power in pushing the steam out of the cylinders," and its wide firebox mate, which has an even smaller nozzle.

BOOK NOTICE.

"Mechanical Traction in War." By Lieut.-Col. Otfried Layrig, of the German army. Translated by R. B. Marston. Published in London by Sampson Low, Marston & Co., Ltd.

This is something of an innovation, as few of us had any idea of the extent to which traction was used in war and in maneuvers. This shows what has been accomplished in heavy automobiles—for that is what they are—and it is interesting to note how large a part steam engineering and mechanics generally play in modern warfare. The book shows the development since the time of Cugnot in 1769.

Working on the Jump.

Section men who think they have a hard time dodging local trains on suburban roads should come to New York and see the tracklaying and reconstruction of the Metropolitan Street Railway on Broadway.

This line is being changed from cable to electricity, and is practically being reconstructed. There are new rails, new conduits and repaving on the whole line, and when it is known that cars are rarely over 100 feet apart (and often much closer), it can be readily seen that there is no chance for killing time. It is a case of jump in, give a few turns of a wrench or blows with a hammer and jump out again. And yet the progress is remarkable when the interruptions are considered.

What One of the Large Locomotives is Doing.

The extremely large engines of the past few years have caused much comment, *pro* and *con*, in regard to their ability to haul load enough to make them economical. The actual performance of one of these monsters is extremely interesting to both the motive-power and railway manager's department, and the following data certainly bear out the advocates of the large engines in their claims for economy.

The Baldwin Locomotive Works recently delivered engine No 600 to the Minneapolis, St. Paul & Sault Ste. Marie Railway, which was the decapod shown in the accompanying illustration. The principal dimensions are as follows:

Cylinders—17 and 28 x 32 inches.

Boiler—68 inches.

Steam—215 pounds.

Tubes—344; diameter, 2 inches; length, 15 feet 7 inches.

Heating surface—Firebox, 223.9 square feet; tubes, 2,791.8 square feet; total, 3,015.7 square feet; grate area, 37.5 square feet.

Driving wheels—55 inches.

Journals—Main, 9½ x 12 inches; others, 8½ x 12 inches.

Truck wheels—30 inches.

Truck journals—6 x 10 inches.

Wheel-base—Driving, 19 feet 4 inches; rigid, 19 feet 4 inches; total engine, 28 feet; total engine and tender—57 feet 4 inches.

Weight—On drivers, 184,360 pounds; on truck, 22,850 pounds; total engine, 207,210 pounds.

Tender—Diameter of wheels, 33 inches; journals, 5½ x 10 inches; tank capacity, 7,000 gallons, 9 tons of coal.

The engine was guaranteed to haul 2,000 tons up a 42-foot grade at 6 miles an hour. This condition has not been fully met, but the record of coal consumption is remarkably good, as will be seen from table.

PERFORMANCE ENGINE 600. AUGUST 21, 22 AND 26, 1900.

Date.	Distance.	Tonnage. Net.	Tonnage. Tare.	Tonnage. Total.	Cars. Loads.	Cars. Emptys.	Ton Miles.	Tons Coal Used.	Pounds Coal per 10000 T.M.
8-21-1900 Ex. East	111	1205.9	790.7	1996.6	58	0	221622 6	11.1150	1044
8-22-1900 Ex. West	111	Max. 1298.8	937.47	2236.27	60	6	222782.8	11.425	1007
8-26-1900	111	1227.7	785.05	2012 75	58	0	223415.25	10.1450	960

There are 7 miles omitted on last trip on account of doubling over a piece of 68 feet grade.

Eighth Annual Convention of the Traveling Engineers' Association.

TUESDAY'S SESSION.

President Stack called the convention to order at 9 o'clock in the convention hall of the Colonial Hotel. The Reverend Ward Beecher Pickard, of Cleveland, opened the meeting with prayer.

President Stack introduced Corporation Council Beacom, who, in the enforced absence of Mayor Farley, welcomed the members to the city in the name of the mayor and the people. Mr. Walsh, upon request of the president, responded in a neat speech to the welcome.

Mr. Delos Everett, upon invitation, responded with a historic and descriptive speech on the State of Ohio and the city of Cleveland. He expressed the regret of Grand Chief Arthur of the Brotherhood of Locomotive Engineers for his absence. Mr. Conger replied fluently to the additional welcome of Mr. Everett.

President Stack then addressed the convention and showed, in a general way, the gradual growth and progress of the association. He recommended that large boiler heads be lagged with a non-radiating substance, in order that lesser suffering may result to the fireman. The president said further that the plan had been followed with great beneficial results on his road.

The secretary's report showed the association to be in a better financial condition than ever before.

The convention hours were voted to begin at 9 A. M. and close at 1 P. M., the last hour of the session to be devoted to the discussion of topical subjects.

Under the head of New Business, the question was brought up of the Traveling Engineers and Air Brake Men meeting at the same place during the same week, one convention following the other. A committee was appointed to confer with the Air Brake Men's committee which was then present.

Mr. Meadows, the chairman of the committee reporting on the best methods to pack journal boxes and cellars, read the report which contained much valuable information, the same being the practical experience of men in that service from all parts of the country. The committee, in summing up, believed that all packing waste should be picked and pulled apart before being placed in the box or cellar; that it should not be allowed to be placed when too soggy; that the packing should never be allowed to get above center line of axle; that hard, dry packing should be guarded against and removed; that the waste should carefully be kept in an elastic condition; that wool waste gives better service in cellars and tender boxes; and that cotton waste served better on top of boxes. In northern climates, however, the

BALDWIN DECAPOD THAT IS DOING GOOD WORK.

wool waste was believed to do better on top of the boxes.

The thoroughness of the report rendered very difficult the bringing out of fresh information in the discussion. Messrs. Hogan, Wallace, Langdon, Meadows, Thompson and others, however, brought forward the belief that more trouble was given by boxes being packed too tightly and with too dry waste than by anything else. They also agreed that rolls of waste at the sides, front and back of the box gave better results than when waste was introduced entangled. Mr. Gleason believed that bad mechanical fit of axles and boxes had much to do with hot boxes. Mr. Monroe agreed with him.

Mr. Smith cited instances where hot boxes were directly traceable to poor material in the brasses and use of poor formula in metal mixture.

Mr. Gilletts expressed a belief that many hot boxes were due to the endeavor to too nearly approach a hot box without actually having it.

After the report had been received, the discussion closed and committee was discharged. Mr. Hedendahl read the report of the committee on "The Proper Handling of Freight Trains on the Road."

After the secretary read an invitation from the Business Men's League to the ladies of the convention, and one to the members to attend a concert in the Armory, the convention adjourned at 1 o'clock, to be assembled at 9 A. M. Wednesday morning.

WEDNESDAY'S SESSION.

The discussion of the paper on handling freight trains was the first thing in order and was opened by Mr. Eugene McAuliffe, who believed, as a result of his experience, that failure to properly test the air gage was to blame for much rough handling of trains and slid-flat wheels.

Mr. Wallace didn't believe in two applications. Messrs. Best, Cass, Ettinger and others strenuously opposed Mr. Wallace.

Mr. Farmer urged the importance of having a high excess pressure in addition to providing ample main reservoir capacity.

Mr. Shragg didn't like the recommendation of the committee that the engines of freight trains should be cut off at water tanks and coal chutes. He also favored the two-application practice and claimed that if it were wrong the principle of the high-speed brake was also wrong.

Messrs. Ettinger and Crane made the remarkable statement that the engineers on their roads doing the smoothest braking were using the single-application method and at the same time these men were sliding the greater number of wheels.

Mr. Hutchins didn't like the drift of the discussion, which seemed to place the blame for slid-flat wheels on the engineer. He believed in better maintenance of brakes and that the traveling engineer could obtain better results by letting the engineer rest and looking closer after the maintenance of piston travel and condition of brakes generally.

Messrs. Nellis and Hutchins asserted that undoubtedly much blame was placed on the engineer wrongly and should be attributed to other and proper sources. Mr. Hutchins cited an instance where brakes dragged in yards and wheels skidded, were blamed on the engineer.

Mr. Best in a few terse words said: "Drop the persecution of the engineer and get after the air brake inspector and his higher officials. Keep up the brakes, instruct the engineer and trainmen properly and you won't have any slid-flat wheels." (Applause.)

Mr. Farmer presented the following resolution: That this association favors, in passenger service, the use of a somewhat heavy initial service reduction, with the object of lessening the maximum amount of pressure reduced and shortening the time of making the stop. Also, that where the rail conditions favor wheel sliding, two applications are best where the second application is light. The motion was put to vote and carried by a vote of 37 to 13.

Upon motion of Mr. Hutchins the paper was accepted, discussion closed and committee discharged.

The committee appointed to meet with a similar committee from the Air-Brake Association with a view of arriving at an arrangement whereby the two associations could meet at the same place, the one meeting closely following the other, reported as follows: "We are unable to make a recommendation as to a joint meeting of the Air Brake Association and Traveling Engineers' Association for the reason that votes were entirely divided for and against a joint meeting of the associations, the interests of both being in remaining as at present. The hotel accommodations, as a rule, would be inadequate for the large number that would attend both associations. Whichever held their meeting first would leave the balance of the week for the other at a time when several of the members would be tired out and desirous of returning to their homes, leaving the convention before the conclusion of the work, which would prove unsatisfactory and unprofitable to both associations."

After a short discussion, the report of the committee was accepted without a dissenting vote.

Mr. Wildin then read the paper on "The Steam Engine Indicator and Its Use to the Traveling Engineer." The paper was one of the best and most complete of any ever presented to the association. It consisted of four parts; part first being on the indicator and simple engines, part second on compound engines and the application to them of the instrument, part third on useful data and calculations, and part four being cuts, description, explanations and instructions to use.

THE OSTRICH, NEAR HOTEL DEL MONTE, ALONG THE SUNSET ROUTE.

THURSDAY'S SESSION.

The meeting was called to order at 9 A. M., and an excellent address was made by Grand Master P. M. Arthur, of the Brotherhood of Locomotive Engineers. He spoke in his characteristic forceful way, and was applauded cordially.

Then the discussion of the paper on the indicator was opened. Mr. Walsh, of the Galena Company, made a valuable addition to the paper by presenting cards of an engine taken while the engine was shut off and drifting down hill. He also showed cards of the engine drifting with the throttle just cracked open.

The paper was so full and complete as

to render any considerable discussion impossible.

Mr. Taylor, in connection with the cards of engine drifting, as brought up by Mr. Walsh, mentioned the practice on many roads of dropping the lever only partly down at high speeds.

Mr. McAuliffe stated his belief that the future of the indicator would probably lie more in the field of old engines than in new. He thought it more important to keep the engines up to maximum service, rather than to merely get a card of a new engine.

Mr. Conger urged all traveling engineers to become thoroughly posted on the indicator and to push its employment in everyday work.

Mr. Nellis believed the wider discrepancy in sister locomotives, as compared with sister ships, was most probably due to the failure to employ the indicator on the locomotive as it is used on steamship engines.

After a short but to-the-point discussion, the report was accepted and the discussion closed. In view of the wide field offered by the indicator and the satisfactory amount of good information brought out, the committee was continued over until next year

The paper on "Smokeless Firing" was then read by Mr. Webb.

Several members stated that they had visited the Burlington, Cedar Rapids & Northern road, where the system of smokeless firing is in such successful operation, and pronounced themselves pleased with the work. The consensus of opinion seemed to be that the success of the Burlington, Cedar Rapids & Northern road was only made possible by the use of good steaming engines, skillful firing and selected, cracked coal.

MISSION SAN LOUIS REY—ALONG THE SUNSET ROUTE.

The convention then adjourned, to meet the following morning at 9 A. M.

In the evening many of the members availed themselves of the invitation of the Lorain Steel Company, to visit the rail mills of the company and witness the process of rail manufacture. The trip to Lorain was made on an electric car of the Consolidated line, and several of the members report phenomenally high speed—one member claiming that a speed of 60 miles per hour was frequently reached.

Those members and their ladies who remained during the evening at the hotel were treated to an informal hop, which lasted until 12 o'clock.

FRIDAY'S SESSION.

The meeting was again called to order by President Slack at 9 A. M., and the discussion on smokeless firing was resumed. There was a very general discussion of the paper, and experiences and opinions exchanged.

Mr. McAuliffe seemed to voice the sentiments of the convention when he said that railroads, as a rule, were attempting to obtain the results achieved by the Burlington, Cedar Rapids & Northern without supplying the proper facilities.

Mr. Benjamin, of the Department of Smoke Abatement of the city of Cleveland, spoke at length on the subject.

After a further discussion of the paper, a motion was made, seconded and carried to have the same subject carried over to next year and treated under a different heading. Discussion closed.

Motion of Mr. Long that the association recommend one shovel of coal at a time as far as possible, died for want of a second.

Mr. Gillette then read the paper on "Tank Valves, Hose Strainers and Suction Pipes." The discussion was short and spirited. The greatest point in question seemed to be that of location of the injector with respect to the water-line in the tank. It was finally agreed that the injector should be placed just above the water-line of the full tank. Paper accepted and discussion closed.

Upon recommendation of the Executive Committee, all members two years in arrears with dues were voted off the mailing list for reports of the proceedings.

The election of officers resulted as follows: President, C. H. Hogan; first vice-president, W. G. Wallace; second vice-president, D. Meadows; third vice-president, H. J. Beck; treasurer, Chas. A. Crane; secretary, W. O. Thompson; Executive Committee, J. R. Belton, W. J. Walsh, C. B. Conger.

Philadelphia was selected as the place for holding the next convention.

Convention adjourned.

Subjects for Discussion.

The Traveling Engineers' Committee appointed on subjects for discussion recommended that the following subjects be discussed: (1) "What Benefits Have Been Derived from the Use of the Indicator by the Traveling Engineers"; (2) "Methods of Firing Locomotives to Obtain the Best Results, all Conditions to be Taken into Consideration"; (3) "Locomotive Lights, Their Care and Operation"; (4) "The Best Method of Taking Care of and Handling the Compound Locomotives"; (5) "Is It a Good Practice to use Grease to Lubricate Locomotive Crank Pins."

About Canada.

Doubtless few people in the United States realize what an extensive country lies to the north of the imaginary line separating the United States from Canada. Few have ever thought that this country has a larger area than that of the United States, even including its latest acquisitions, Porto Rico and the Philippines.

Possibly many in the United States who imagine themselves fairly well posted regarding all the nations of this continent will be surprised to learn that Canada has such great advantages in the matter of transportation facilities. They will hardly credit the statement that Canada has $180 per head of her population invested in railways, while, according to the latest reports of the Inter-State Commerce Commission, the United States has $150 per head so invested. The efficiency of the 17,400 miles of railway in Canada is illustrated by the fact that when the British Government recently made inquiry about the carrying power of the Canadian Pacific Railway in order to ascertain at what rate per diem troops could be transported from the Atlantic to the Pacific on the way to China the reply was, 5,000 troops a day and the time 100 hours for each shipment of troops.

The Phleger Locomotive.

BY C. H. CARUTHERS.

From 1853 to 1860 the firm of Richard Norris & Son built at their works in Philadelphia, Pa., a number of locomotives having a peculiar boiler designed by Leopold Phleger, a German, and supposed to be especially adapted to rapid steaming and smoke-consuming. This boiler was 24 feet long over all, its firebox and combustion chamber together being 11 feet long, and the flues nearly 11 feet in length, 230 in number and 2 inches in diameter.

These flues completely filled the barrel of the boiler, which was 39 inches in diameter, and upon the barrel's top was formed the dry pipe from which at the front end, just behind the smokebox, branch pipes carried the steam around the outside of the boiler to the steam chests, which they entered on the back end between the cylinders and chests.

This steam space or dry pipe on the top of the barrel was about 8 or 10 inches in height and rounded on top, and upon it was placed the blower, bell and sandbox.

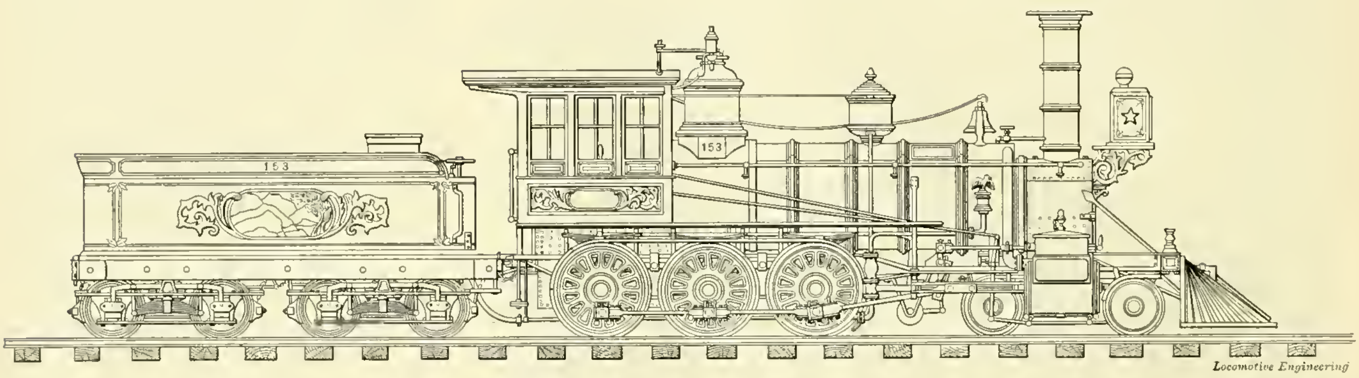
Four ten-wheel engines of this type were furnished by Messrs. Norris to the Pennsylvania Railroad Company between 1857 and 1862. The first one, No. 210, had cylinders 16 x 24 inches, 49-inch drivers, and weighed 65,300 pounds, 45,400 pounds of which were carried on the six drivers. The next two were Nos. 152 and 153, which had 17 x 24-inch cylinders and weighed 68,200 pounds, 46,200 of which were carried on the six drivers. Otherwise these three engines were exactly alike. The four-wheel trucks were of "spread" type; the cylinders and all the drivers were in the same line; the main rods and eccentrics were attached to the forward pair of drivers, and the shifting links were used.

The drivers stood quite close together, but somewhat farther back from the truck than in ordinary ten-wheel practice, and the rear pair were slightly overhung by the firebox. They were of a peculiar form, the rim and flat outer edges of the spokes forming a continuous surface, and the tops and bottoms of the intervening spaces were

landscapes in center of cab panels, and arabesques on either side of these landscapes. The frame of cabs in which these panels were was of varnished black walnut.

Two full-stroke pumps worked in the usual manner from the crossheads, were attached to each engine, but no injectors.

The tenders were of standard type, on two Bissell four-wheel trucks, and were painted with vermilion guard and frame; but sides of cistern in emerald green, with border of darker green and large landscapes in the center, and the number in small white figures on the guard. The wheels of the tender were painted in vermilion. A singular coincidence occurred in the preparation of the drawing of engine 153 from which the accompanying tracing was made. The writer well remembered the colors, striping, etc., but did not recall distinctly the landscape on the tender, except that it was a mountain scene, with an antlered deer in the foreground. As the drawing was a line drawing, shaded in the original water colors,



210 as Rebuilt in 1861

152 & 153 as Rebuilt in 1864-5

OLD PHLEGER LOCOMOTIVE.

It was covered by a jacket of same type as the boiler, and terminated, at its rear end, in the wagon-top casing above the combustion chamber.

This wagon top was different from that of other engines, only in being joined to the barrel by a vertical plate instead of a sloping one. It carried a 30-inch dome of the standard type, although one at least of the engines had the old "haystack" type of dome. This was an engine built for passenger service, and called "Wyoming," a colored lithograph of which is yet in existence.

The firebox, externally, had a flat top, which was attached a few inches below the highest point of the wagon top, and sloped downward toward the rear. Inside it contained a diaphragm of iron somewhat similar to the fire-brick arch now in use. This diaphragm was of course made in the form of a water space, and, in conjunction with a water wall, separated the firebox from the combustion chamber. The firebox extended but a short distance below the frames.

rounded, and each space was bordered by a raised strip, about 1 inch wide, which was polished. The outside of these wheels was strongly convex.

Straight stacks were used, surmounted by a cap of polished brass, and having three fluted rings at intervals between this cap and the saddle.

Large bands of fluted brass held the Russia-iron jackets of the boiler and the surmounting steam space in place. The sandbox, cylinder and cylinder-head jackets and covers, steam chest and dome casings, front of wagon top, check-valve casings and large hand-holds on back of cab were all of highly polished brass, as well as circular plates on ends of all axes. The cow-catchers were of wood. The cabs were handsome, well-lighted affairs with three large windows of cherry frames on each side, and the headlight stands were of cast-iron arabesque work.

The painting was: Dark-green wheels, vermilion cow-catchers, bell frames, cab panels and vertical support of cab roofs, headlight brackets and bases of domes;

and the draftsman was like Mark Twain, who said he was poor on landscapes, but good on donkeys, and employed an artist to draw the landscape, but drew the donkey all himself; so in this instance an artist's work in the form of a transfer picture was used for the place on the tender occupied by the landscape, and lo! when the white covering which concealed its outlines was removed, behold an antlered deer in the foreground and all about him lofty mountains rising from a smiling lake at their feet—almost precisely like the original painting!

Although the fireboxes of these engines extended nearly to the back of the cab, the front end of the tenders did not follow the type then prevalent in such construction, of having the frame longer between the water cistern and the cab to give room for firing, but was of same length as on engines with short fireboxes.

In October, 1861, another of these engines, No. 223, came into the Pennsylvania Railroad Company's possession. While the boiler was similar to the others, the cylinders were only 15 x 24 inches. The drivers were of the T-spoke type so often used by the Messrs. Norris. The sandbox was a large octagonal affair, which was fitted closely to the superimposed steam space and the boiler barrel, rising only a few inches above the latter, but reaching down quite to the center. The cab was of white ash, varnished; an ordinary conical stack of Norris standard type was used; and this engine weighed somewhat less than any of the other three. It had but little ornamental brasswork.

The painting was: Green drivers and pony wheels, vermilion sandbox with number in small white figures on the sides; green tender with vermilion frame and guards, and the name, "Pennsylvania Rail Way" in white letters in the center of each side of the cistern. The tender wheels were black, and the Bissell truck frames brown, with a few white stripes.

There was one point upon which it seems difficult to obtain a satisfactory explanation, viz.: the discrepancy between the time of building, as evidenced by the construction number, and the time at which they were purchased by the Pennsylvania Railroad Company, as follows:

No. 153—Norris number, 903; bought by Pennsylvania Railroad November, 1860.

No. 152—Norris number, 904; bought by Pennsylvania Railroad November, 1860.

No. 223—Norris number, 906; bought by Pennsylvania Railroad October, 1861.

No. 210—Norris number, 912; bought by Pennsylvania Railroad October, 1858.

Nos. 152, 153 and 210 were purchased to replace engines of same numbers sold to other companies, but 223 was original engine of that number.

No. 210 was rebuilt at Altoona during 1861. The only change was in the boiler. All of the dry pipe was removed from the top except about one foot at the front. This entered a small dome which was placed immediately behind it. This dome contained a slide throttle-valve, moved by a rocker whose shaft came out at the side of the dome, and by an arm and long rod was carried back to the engineman's lever in the cab.

From the barrel back a new wagon-top firebox was made which extended almost to the rear of the cab; and had the original 30-inch dome upon it, but inside of the cab. This dome retained the safety valves and the whistle, and the small dome at the front had a tallow cup placed upon its top to lubricate the slide throttle-valve.

The sandbox retained its original position, but the bell was on the wagon-top, just in front of the cab.

Gill & Co.'s coal-burning firebox replaced the Phleger one, and a straight stack with saddle and cap of cast iron similar to those still in use on many of the older Pennsylvania Railroad passenger engines, replaced the brass-encircled original.

All ornamental brasswork was removed, and the painting was of a style long used at Altoona for engines in the freight service—vermilion wheels under engine; cow-catcher and frame of cab, dark Tuscan red; cab panels, green, with neat arabesques in yellow; sandbox, burnt umber, with black cornice and base, and number in white figures on the sides. Tender—Black guard, dark-green frame and cistern, green center panels, with number on it in large figures, preceded by "No.," all in white, shaded in yellow and brown, and these panels were surrounded by a border of dark Tuscan red.

The other three were all rebuilt about 1864 at the Pittsburgh shops. They received long, shallow fireboxes with standard wagon-tops. The dry pipes were placed inside the boilers and the branch pipes in the smokeboxes. Conical, or balloon, stacks were used, and all ornamental brasswork removed. All parts were painted with burnt umber, and a few neat stripes and the inscription "Penna. R. R." on the sides of the tenders was the only decorative work. Sellers non-lifting injectors also replaced the pumps.

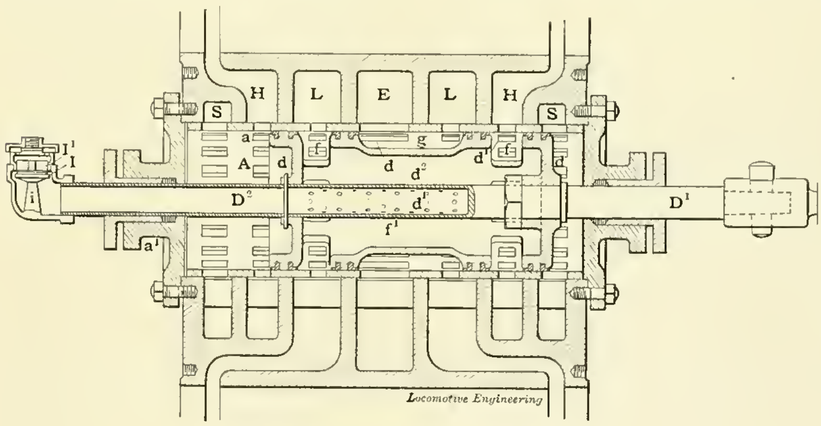
All four of these engines, Nos. 152, 153, 210 and 223, passed out of service between 1869 and 1872, after fairly efficient service both in their original and in their rebuilt forms.

Purdue University entered upon a new school year on Wednesday, September 12th, with a larger number of students in attendance than ever before in its history. The number of Freshmen will reach three hundred and fifty and the total enrollment for the year will exceed one thousand. It is significant that the increase in the attendance is very largely within the schools of engineering.

Preparations have been making during the summer in anticipation of a large attendance. Laboratory equipment in many departments has been increased, and one-half of the large building hitherto known as the Men's Dormitory has been so remodeled as to supply a dozen excellent, additional recitation rooms. Both the new comers and the old are, therefore, being well cared for.

Relief Valves for Vauclain Compounds.

The illustration almost explains itself, showing as it does the relief valve in the end of the hollow extension of the valve rod. Perforations in the rod at the center of the valve admit live steam to close the valve when engine is working, and allows air to enter when drifting with steam shut off.



RELIEF VALVE FOR VAUCLAIN COMPOUNDS.

The modern business man realizes the value of advertising, and takes advantage of every incident that presents itself. A recent example of this is where Mr. John N. Abbott, of the Consolidated Electric Lighting and Equipment Company, is using the burning of cars in a wreck to emphasize the safety of their system of lighting, in regard to fire.

The Westinghouse Electric and Manufacturing Company have favored us with two of their new publications—"Electric Power" and "Drop in Alternating Current Lines." The former shows by half-tone reproductions the applications of their electric motors to nearly all classes of machinery, including machine tools, cranes, bleaching machinery, grain elevators, pumps, fans, etc. It is printed in four languages. The latter is a method for calculating drop in alternating circuits by Ralph D. Mershon, and is of value to all dealing with alternating currents. It also describes the type "F" Westinghouse compensator, and gives instruction and tables regarding it. They are handsome pamphlets, as well as valuable ones.

If a locomotive steams well and cleans out the extension front end while the diaphragm or deflector sheet is located ahead of the steam and exhaust pipes, and this sheet is changed to a place back of the steam pipes, you are apt to see an entry on the work book like this: "Engine doesn't steam; front end fills up." Moral—Let well enough alone.

Railroading in the Early Days.

BY WALTER S. PHELPS.

After years of farm life it was a pleasure to know that my prospects were good for a trade, and on Tuesday, May 10, 1842, at noon, the writer commenced to learn his mechanical business at Rogers, Ketchum & Grosvenor's Locomotive Works, Paterson, N. J., William Swinburn foreman, and for ten months before promotion was in continuous employment, drilling boiler rings, copper boiler heads (or flue sheets), etc., for Peter Donahue and Peter Kagg, boiler makers. The first named was the original owner of the present Union Iron Works of San Francisco, Cal. He ventured a trip around the Horn in '49 to dig gold, and I was told became stranded in California's great city of to-day, and began to work at his trade, repairing boilers, engines, etc., to incoming vessels, the business becoming a veritable gold mine in itself, for a few years after he sent for his mother and family. A brother (Thomas Donahue) living with me in Schenectady, N. Y., in 1851, where he was employed as machinist at the Schenectady Locomotive Works, took his departure from there.

At the Rogers & Co. Locomotive Works were Robert and George Benjamin, who hung cylinders and guides to locomotives; E. Personette Gould, who mounted pumps and their water connections and put in all the copper steam, branch, dry and exhaust pipes, with the throttle, and ground joint connections. Thomas Moffett and Thomas Pettigrew fitted all guides and rocker shafts, finishing them and making ready to be mounted on the engines by the Benjamin brothers. Harry Close was also employed on the vise work. Old Mr. Sweet, father of the Michigan Central master mechanic after the death of Mr. Newhall, was another workman. Judge J. Warren, of Paterson, was an apprentice, also his brother William, who was killed in an explosion of a new boiler about the year of 1852 or 1853 in the shops.

At this date Major Hughes was master mechanic of the Passaic Railroad from Jersey City to Paterson, and Colonel Whistler was superintendent and chief engineer. The motive power consisted of two locomotives (grasshoppers); the engineer's position while running was on the platform in front (with the ordinary hand rail of today used on coaches, street cars, etc.); the trips were two a day, each way over the road (Sundays excepted)—morning and evening. The boiler was upright, with some 200 1½-inch copper flues; stack on top of boiler, and cylinders upright, working under levers attached to the sides of the upright boiler by a heavy cast-iron knuckle joint. The extreme ends of these two levers were connected by rod to a crank upon a shaft that had a spur gear wheel between the pillow blocks or bearings, and this gear drove a pinion on another shaft that extended over the frames outside, with crank and connections to the driving wheels—four in number—of about 34 inches diameter. The coaches being first-class—three divisions—lettered in alphabetical order—with a narrow running board outside for the (safety of) conductor. I should have stated the location of the fireman. He was between the boiler on one side and his coal and water on the other, and had no communication with the engineer whatever while traversing the rail. His duties were to keep up fires, attend to filling the boiler while the engine was running, and feed the fires, also see the fan was in operation for forced draft, as no exhaust was used then on these two engines that I recollect of.

These engines were made, I think, at the Cold Spring Foundry and Machine Company, Mattewan, N. Y. This firm made several, one of which had three frames (or one central frame), that was on the Long Island Railroad as late as 1854, when Mr. Lyons was master mechanic and Abiah P. Duane was general foreman.

At this time I took a new six-wheeler Baldwin engine to run there (Wyandank by name)—a very clumsy engine—elevated cylinders, independent cut-off and badly squared on wheels, for in about six months' work and while going over to Greenpoint, and a little late at Riverhead, I nearly threw her off the track on the curve. Slowing down as soon as possible, I found the difficulty to be with the leading left-hand driving wheel. The flange had turned about one-third of its circumference in towards the frame on an angle of about 30 degrees. I ran her slow to Greenpoint, and that night Miller, my fireman, two brakemen and Conductor Samuel Derling, assisted me to change the wheels, putting the leaders under the footboard and the trailers in lead. I got the pilot off and on, wheels changed, and in steam inside of twelve hours, or was ready to leave Greenpoint at 7.15 A. M. for Brooklyn, with the market train for Fulton and Washington Markets only fifteen minutes late, and made time. As the company was short of motive power this engine was used in service until fall, when I turned her over to George Martz, an engineer, and left with Schenectady engines for Wisconsin railroads.

Along in these years engines of various designs were built by the Norrises and Baldwin, Philadelphia; the Swinburne & Jackson Company, of Paterson, N. J.; J. Southers and Hinkley, Drury and others, of Boston; Amoskeag, Manchester, N. H.; Lowell Machine Company, Lowell, Mass.; Portland Company, of Portland, Me.; Ross Winans, Baltimore; Menomonee Locomotive Works, of Lee & Walton; James Waters, superintendent, followed by Wm. Romans, who afterwards became master mechanic of the Old Piqua Railroad out of Columbus, Ohio., and several others were sending out locomotives. It was my fortune to run across members of other works who went often to the same roads as myself—Hiram Moak, who represented Boston; Dyer Williams, James Seath and Hank Beach, who took locomotives to Canada; George Hollingsworth, who represented Rogers, and others I do not now recall by name. At this time a few Dunham engines were in use. His engines were all straight hook, using starting bars to work the rocker shaft, until the hook would drop and catch the pin. Even Baldwin and Rogers made use of this device at this time (I speak of 1848 and still later), until the V-hook was more generally used, or up to about 1854, when the link was used to guide the pin from hook to hook on the eccentric arms.

While with Rogers, Ketcham & Grosyener, about the year 1844, the Syracuse & Utica Railroad Company made a contract for two locomotives, double driving wheels (or two pair) of the Rogers firm; Thomas Rogers signing the contract on behalf of that firm, and Heman H. Phelps and David Henderson Beggs representing the railroad company. They were considered immense. These engines had the cylinders connected with the back drivers, with the rocker shaft on either side of the footboard, with eccentrics and arms under the foot-board, and long valve rods extending to the steam chests either side of the smokebox or inclined cylinders. A humpback smokestack (David Mathews patent) was placed upon each. The boilers were the old round dome style of former days. These engines were named after the Indians, "Oneida" and "Onondagua," weighing about 20 tons. The company had the following engines, of about 12 tons, "Utica," "Rome" and "Syracuse," run by Cornelius Cary, James Dunn and James Bonner (who was in later years an engineer upon the Chillicothe Ohio road, and was killed by his own train at Blanchester).

While an apprentice I worked upon nine engines for Cuba, three for Mad River Railroad of Ohio, and one for the Northern Cross Railroad to Meridosia, Ill.; the "Abner Chichester" and the first engine for the Erie, the engine "Brooks" for the Long Island, and several for New Jersey railroads and the Mad River Railroad of Ohio.

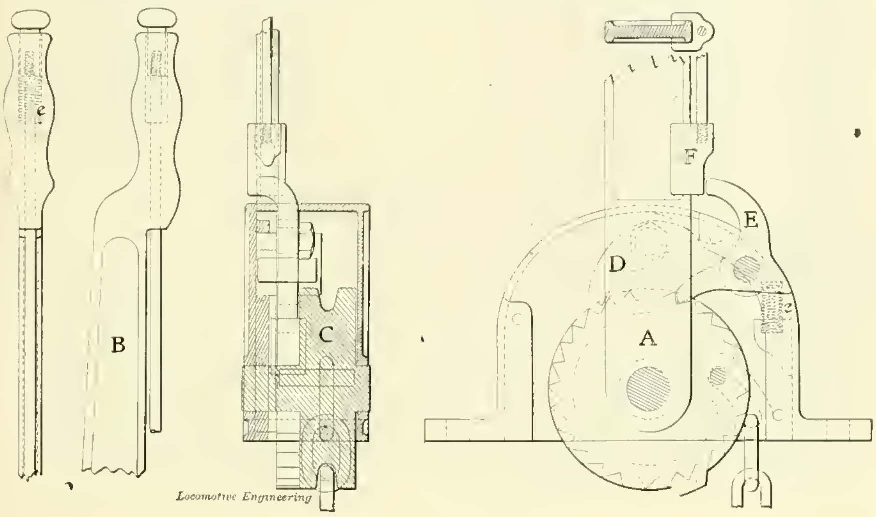
Upon one of my visits to Trenton and Philadelphia I saw, at Bordentown shops (Camden & Amboy Railroad), a very curious engine attached to the passenger train (delayed to set out the old spring packing of those days). It was single-driver and built-up wheel centers of cast iron, wrought-iron rods and wood spokes, boiler sloped at the back end from the top to the ashpan, and using a fan for blower. There were one wood wagon or car attached and four cars of four-wheeled English pattern apartment coaches; at that time first class, or 12 miles per hour; extra speed to 18 miles per hour. This in 1845 was considered fast.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Hand Brake for Vestibuled Cars.

A hand brake for vestibuled cars must possess three requisites, viz.: It must have a good leverage, so that a man can apply the brake with sufficient force to control a heavy car; it must be so located that it is accessible for trainmen to operate instantly, without changing any of the attachments, and it must be so located as to be out of the way of the vestibule, its side doors or platform trap doors.



HAND BRAKE FOR VESTIBULED CARS.

Messrs. Seymour and Kahler, of New Albany, Ind., have lately patented and put on the market a lever operated brake, which is herewith illustrated. The ratchet wheel *A* and chain sheave *C*, with its case, are located on the end sill of the platform, with the lever *B* coming up beside the end railing or hood. When not being operated, this lever is perpendicular; when being operated it is moved towards the middle of the platform gate.

The pawl *D*, fastened to lever *B*, engages with the ratchet wheel to wind up the brake chain when the lever is moved over, and the pawl *E* holds the ratchet wheel from coming back. The leverage of this device is such that a man can apply a force of 1,600 pounds to the brake chain.

To release the brake, the sliding dog *F* is pushed down by the knob on top of the lever *B* and its rod, extending down to the dog *F*. This engages the upper end of pawl *E* and lifts it out of the ratchet wheel, which allows the chain to run out and release the brake. The pawl *D* is raised out of the ratchet wheel, when the lever *B* is perpendicular, so that at the place where the pawl *E* can be unhooked the other one is also unhooked from the ratchet wheel.

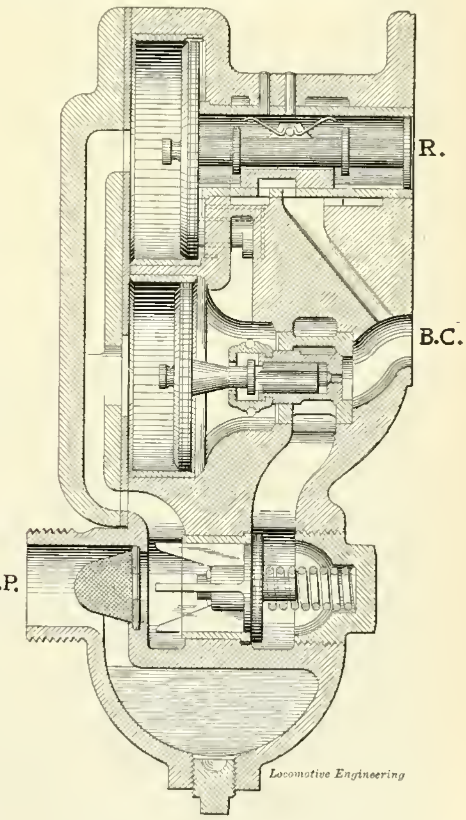
All the parts of this device are of malleable ron, except the two small coiled springs shown at *e e*, and can be furnished at a moderate cost. Parties desiring further information should write Messrs. Seymour and Kahler.

A Curious Railway Train Brake.

It is not so long ago, says Cassier's Magazine, that some enterprising genius suggested that, for quickly stopping vessels at sea when in danger of collision, a form of marine brake might be used which, in its essentials, should consist of large wings or vanes, hinged to a ship's sides below the water line, folding closely to those sides when not in use, but capable of being swung out at right angles when needed, in which position their resistance to the ship's forward movement would be instantaneous and highly effective. A few discouraging attempts were made with a contrivance modeled somewhat after this pattern, but it is interesting to recall that more than thirty years ago substantially the same idea was embodied in a patent for a railway train brake granted in Great Britain. The brake proper in that case consisted of a large vane, extending across the roof of a railway coach, and so hinged that it could be raised to an upright position by means of ropes and a large nut traveling along a screw, which latter could be turned as desired by a train attendant. The vane in its upright position, of course, added in a more or less appreciable degree to the atmospheric resistance encountered by the train, and upon this the theory of its action was based. With over a quarter of a century's progress in railway brake development to look back upon, this early winged contrivance seems like the outcome of a childish fancy, but even at the time of its proposal there appears to have been no evidence to show that it was ever put to trial.

"Brake Failure."

A New Jersey news item, in chronicling the wreck of a trolley car which crashed into a railroad train at a grade crossing near New Brunswick, says: "The motorman saw the train approaching and applied the brakes, but they refused to work properly." How much longer will the public permit itself to be hoodwinked with this flimsy subterfuge? And how much longer will it continue to pack itself into a death-trap—a crowded trolley car with a hand-operated excuse for a brake? When will motormen learn that railroad trains have right of way at grade crossings, and that a cautious approach and dead stop before crossing over is the only safe operation of trolley cars at grade crossings? How and when? In the meantime the public will continue to run deadly risks and the brakes will "refuse to work properly."



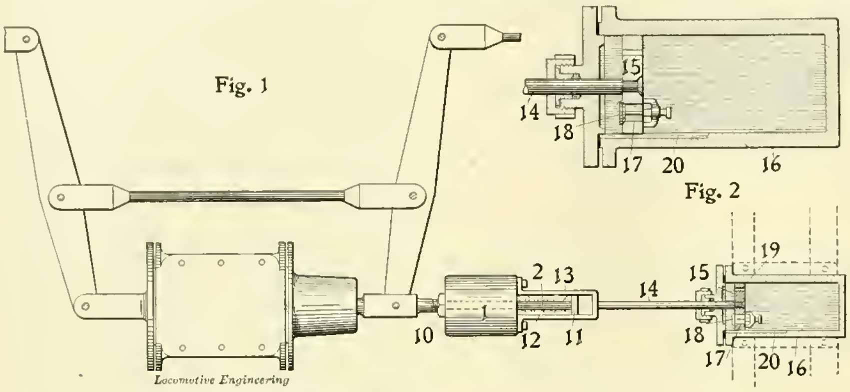
A RECENTLY PATENTED TRIPLE VALVE.

The time is now here when triple piston rings must be looked after. The fitting of these rings to the cylinder is a delicate and important operation, and the most refined care should be used.

Braking Power Increased by Inertia Force.

This present invention of Mr. H. H. Westinghouse provides, in combination with such inertia device, weight or mass, means whereby the inertia device may be temporarily locked in position when the brakes are first applied and then gradually released, so as to gradually reduce the additional braking force due to its inertia.

In Fig. 1 of the drawings the improvement is shown applied to a fluid-pressure-brake mechanism in which an inertia device or weight 1 is mounted on an extension 2 of the rod 3, which is connected to and operated by the movement of a piston within the brake cylinder. The rod 2 is provided on one end with a head or collar 11 and is surrounded by a spring 12, which bears at one end on the head or collar 11 and at its other end against the inertia device or weight 1, so as to hold it normally in contact with a shoulder or nut 10 on the extension of the piston rod.



DEVICE FOR INCREASING BRAKE POWER BY INERTIA FORCE.

A yoke 13 is secured to the weight 1 and is connected, by means of a rod 14, with a piston 15 in a cylinder 16, which is charged with liquid. The piston 15 is provided with a comparatively large passage 17 extending through it, which is controlled by a non-return valve 18, and a smaller valveless passage 19 also extends through the piston. In the wall of the cylinder 16 is formed a groove 20, which extends from the left-hand end of the cylinder to the right, a distance somewhat greater than the stroke of the piston in the brake cylinder.

The inertia device or weight 1 operates to augment the braking force only when the brakes are applied with sufficient suddenness to cause the weight to slide on the rod 2 and compress the spring 12. In applying the brakes when the piston rod 3 is moved slowly outward, the weight 1 may not move relatively to the rod 2, and the piston 15 in the cylinder 16 will then be moved a distance equal only to the stroke of the brake cylinder piston. This movement will be effected with but little resistance, since a comparatively free flow of liquid from right to left may take place through the passage 17 in the piston and through the groove 20 in the wall of the cylinder.

When the brakes are released after such an application, the return flow of liquid from the left of piston 15 to the right will take place through the groove 20 and the passage 19, the valve 18 being closed. The capacity of the groove 20 should be such as to permit the piston 15 to return with the desired rapidity in releasing the brakes.

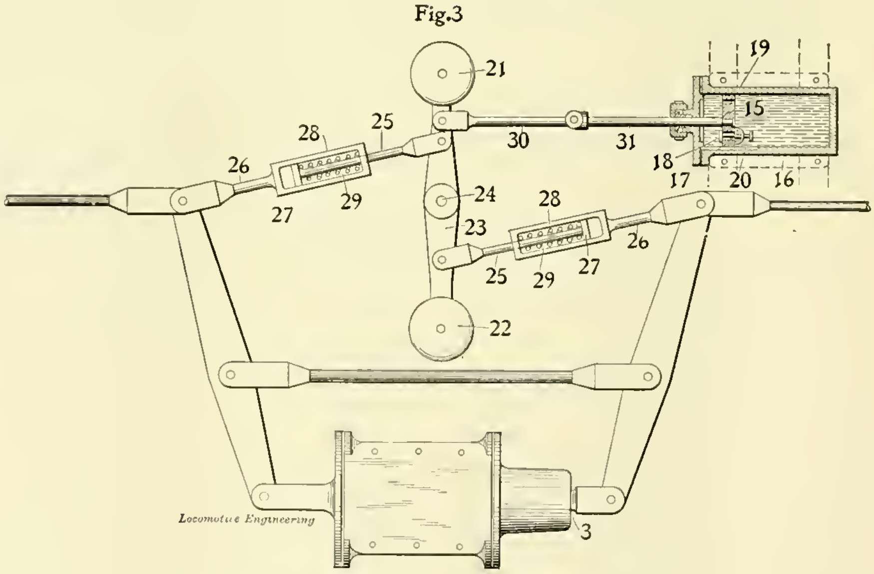
When the brakes are applied so as to cause the piston rod 3 to move suddenly outward, the weight 1 will continue to move after the piston rod 3 has completed its stroke and will compress the spring 12 and move the piston 15 to the right beyond the right-hand end of the groove 20. When the weight 1 reaches the end of its movement, the pressure by which the spring 12 is compressed acts, in addition to the air pressure in the brake cylinder, to press the brake shoes to the wheels. The valve 18, controlling the passage 17 in the piston 15, is closed and the fluid on the left of the piston 15 will temporarily prevent the release of the additional pressure. The spring 12, acting on the weight 1 and through the yoke 13 and rod 14 on the piston 15, will tend to move the piston 15 to the left, and the flow of fluid through the passage 19 from left to right of the piston 15 will permit this movement, so that the spring 12 will gradually expand and the additional pull on the piston rod 3 due to the inertia of the weight will be released.

In the construction shown in Fig. 3 of the drawings the piston rod 3 of the brake cylinder is connected, as in Fig. 1, to the brake cylinder levers. Weights 21 and 22 are mounted on the ends of a lever 23, which is pivoted at its middle to a fixed support on the car by means of a pin 24.

When the brakes are applied, the outward movement of the brake cylinder piston rod 3 will cause the cylinder levers to pull on the brake rods and to push on the rods 26 and 25, and thereby to partially rotate the lever 23 about its pivot. If the brakes are applied by a slow or gradual movement of the brake cylinder piston rod, the inertia of the weights 21 and 22 may not be great enough to cause any considerable compression of the springs 29, and the piston 15 in the cylinder 16 will then move a limited distance to the right. When this movement of the piston 15 is being made, the liquid in the cylinder 16 on the right of the piston 15 flows freely to the left through the passages in the piston and through a groove 20 in the wall of the cylinder, the length of the groove 20 being such that the piston does not move beyond it. When after such a gradual application of the brakes the brakes are released, the piston 15 may be moved to the left without any considerable retardation, because the liquid on the left of the piston is free to flow around the piston to the right through the groove 20.

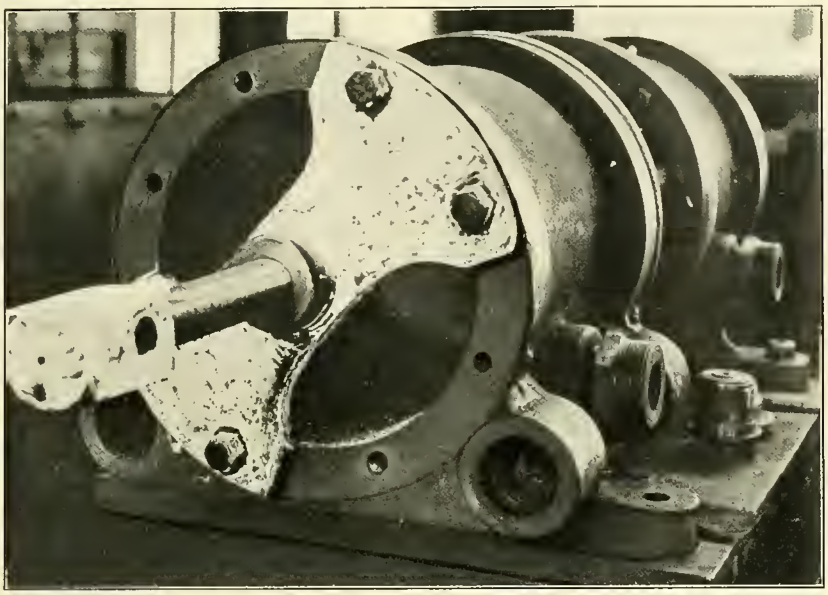
When in applying the brakes the brake cylinder piston rod 3 is moved out with any degree of suddenness, a correspondingly rapid movement will be given to the lever 23 and weights 21 and 22 and the inertia of the weights will tend to give them an increased travel by which they will act through the rods 25 to compress the springs 29 and to exert an additional pull on the rods 8 and 9 equal to the force required to compress the springs.

Fig.3



DEVICE FOR INCREASING BRAKE FORCE BY INERTIA.

It will be seen that the cylinder 16 and piston 15 operate in the manner of a cataract or dash-pot to permit and to regulate the gradual release of the additional pull on the rods 8 and 9; but they operate not merely as a releasing device, but as the means by which an otherwise momentary force is converted into a continuing force.



DEVICE FOR REMOVING PISTON ROD FROM 9½-INCH PUMP.

CORRESPONDENCE.

Device for Removing Piston Rod from Head.

Editor:

I am sending you for illustration in Locomotive Engineering photographs and drawing of a piston-rod extractor for 9½-inch air pumps, which I have found very useful. By the use of this device, the air piston is removed from the rod without any damage to the end of rod. By simply removing the nuts on the end of the piston rod and pushing the piston against the center piece and running screw against end of rod, the work is done.

The same device can be used for the 8-inch air pumps by turning the crosshead to fit the 8-inch pump and drilling holes for same.

In making the crosshead, care should be taken to have the hole perfectly straight and in the center of the head.

Wm. Malthaner.

Green Island, N. Y.

Testing and Repairing Worn Triple Piston Rings.

Editor:

I have failed so far to find in Locomotive Engineering an article by an air-brake man on his way of repairing worn triple valve cylinders, except one man, who claimed to get good results from the use of a lapping machine and Trojan grinding compound for truing out cylinders. Any air-brake man who has ever visited the Westinghouse shops can testify to their method of grinding the cylinder and its piston ring as perfect. But where triples are repaired at railroad shops this cannot always be done, as it takes some preparation for so complete a job.

I have found it necessary on worn triple cylinders to rebore a few in the lathe; but do not think it good policy to bore the cylinders in lathe, as the tool marks cause a friction which will soon wear out the ring.

I use a grinding machine the same as illustrated in November, 1899, issue of Locomotive Engineering, with fair results; but find it impossible to grind out fine lathe feed marks in cylinder. I also use standard thickness rings in pistons, closing the groove to same by using a press when necessary.

I also test all triples on a rack representing an engine and five cars, by using the following ring test: I have a pipe connected to the brake valve reservoir pipe and running to the ¼-inch plug hole tapped into brake valve for connecting test gage on F-6 valve. In this pipe I have a cut-out cock.

After making reduction in train line and lapping brake valve, I open the cock in pipe just referred to, thus equalizing the pressure above and below the equalizing piston in brake valve as I increase train line from main reservoir. I have a small pipe running from main reservoir to train line with cut-out. In the connection of this pipe I have a diaphragm in which is 1-32 inch hole. After opening the cocks in the two pipes, allowing pressure at 90 pounds from main reservoir to increase train line through the diaphragm, I can now read the train line pointer on brake valve gage, which will show the increase, which is mostly 2½ to 3 pounds when the release follows. With this test the manufacturers' triple requires less than 2 pounds.

Will someone kindly give us an article on a device for grinding out worn triple cylinders, or what make grinder they use, in place of reboring in lathe, and a better plan for grinding in piston packing rings. Many air-brake men would appreciate this favor.

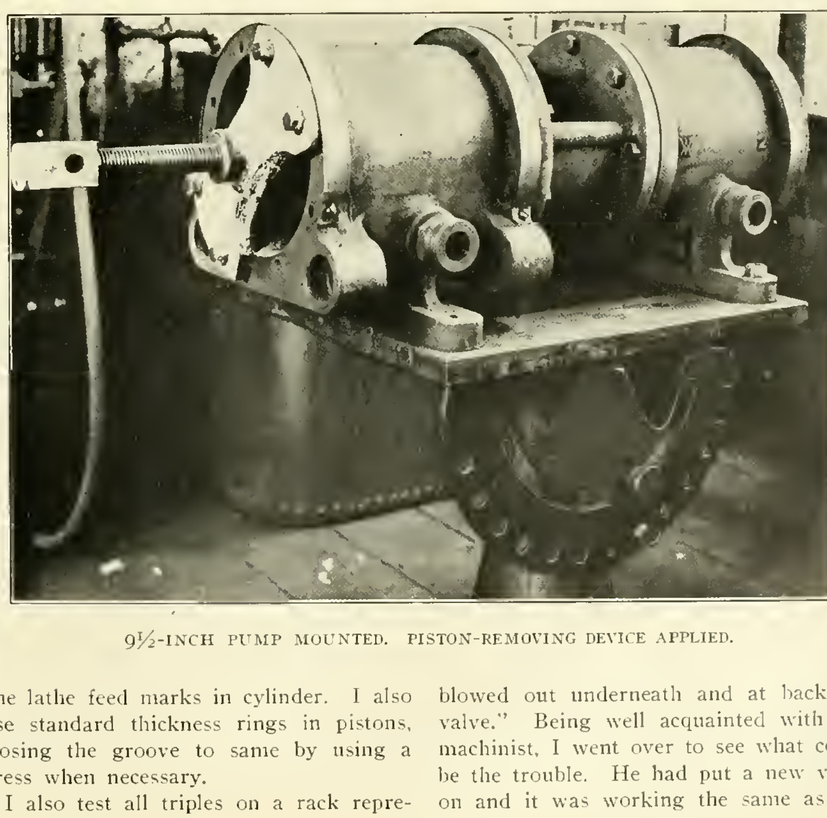
R. G. Shaffer,
C. V. R. R.

Chambersburg, Pa.

One Trouble With an E-6 Brake Valve.

Editor:

While at one of the terminals I saw an engine taken off a through train, and brake valve reported, "Would not work, as air blowed out underneath and at back of valve." Being well acquainted with the machinist, I went over to see what could be the trouble. He had put a new valve on and it was working the same as the



9½-INCH PUMP MOUNTED. PISTON-REMOVING DEVICE APPLIED.

one reported and taken off. Upon examination he found the union between the brake valve reservoir and brake valve leaking very badly. When the union was tightened up, the brake valve worked all right. A little knowledge and thought would have overcome this trouble and saved an hour's delay to an important through train. W. H. W. ROBERTS.

Cincinnati, O.

Some Good Points on Brake Maintenance.

Editor:

I consider Blackall's letter on cleaning triple valves and cylinders a good thing. I have had a good deal of experience in that line myself on several different roads, and I never saw anyone come around and show the men how to clean and equalize the brakes.

Waste is bad if put in slide valve seat, for when it is taken out it is liable to leave two or three threads on the seat, and when the triple is put back, it curls up under the slide valve, causing it to blow through the retainer. We use rags or the leg of a pair of old overalls, if clean. All roads don't furnish chamois.

I use a tool made from a split key, and find it very handy. To make it, take a split key, ½ inch wide, and straighten it out. Then put it in a vise and turn up ½ inch from end at right angle and file it down to a point about ⅛ inch wide. The other end file like a wood chisel. It is very handy to clean the leakage groove in the brake cylinder, scraping rust from check valve case, cleaning drain cup and between cylinder packing leather and piston.

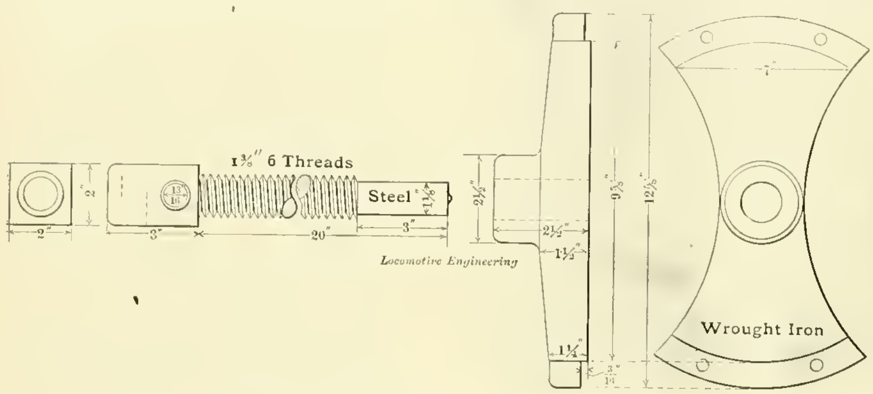
Kerosene is the proper thing to get the dirt off. Instead of using Fig. 7 that Blackall gives, I use a piece ⅜-inch steel, 6 inches long, beveled off on one end, and when the emergency valve case sticks, I drive the tool lightly between the valve case and the check valve case gasket, and it doesn't hurt either of them. I use emery cloth, No. 0, for check valve case, when it has no brass bushing in it, to get the rust off.

I don't believe in putting oil through the oil plug hole. Enough can be put in when the piston is out, if it is not too thin. I don't know whether grease will be a success or not, for when the piston travels out it may take the grease with it, and when it releases, it may leave the grease standing in the middle of the cylinder. After a while it will probably become hard and be liable to cause air to blow by the packing leather.

The triple valve packing ring should be well soaked with kerosene till you can turn it around with your hand. I use a clamp for holding back cylinder head on. It is ½ x 1 x 3 inches diameter, with a set-screw through the center, and it doesn't slip. A pencil brush is good for cleaning the end of the graduating valve, through port *W*. Sometimes it is very dirty on account of too much oil being used.

ED. NEVIN.

Pt. Richmond, Cal.



DEVICE FOR SEPARATING PISTON ROD AND HEAD.

Location of Retaining Valves.

Editor:

In the answer to Questions 114 and 116, September LOCOMOTIVE ENGINEERING, you refer to a most inexcusable practice that cannot be too strongly condemned. The Western road referred to found the greatest danger arose from the retaining valve being located beneath the car. To shorten or avoid the two stops for turning up and down the valve handles, few or none of the valves were used, hand brakes being employed instead. The stop necessitated at the foot of grade is dangerous where there is a closely following train. As a result, the Western road has almost completed the change back to the standard location.

Concerning the making up of time lost by stopping to turn up the handles of valves beneath the cars, there is no more undesirable place to make up time than in descending a grade requiring the use of retainers. There is no advantage gained sufficient to justify making up lost time down such grades. F. B. FARMER.

St. Paul, Minn.

[The making up of time referred to was meant to be made up anywhere else than on the down grade.—Ed.]

Air Pump Packing Rings.

Editor:

There is too little attention paid by some roads to repairs of air pumps, particularly as to packing rings. They are often left quite rough, and are so hard that they cut the cylinders. Then, they sometimes have altogether too much spring to them, and wear the cylinders unnecessarily. A little attention to these points will give much better results and save money to the roads.

There is another point, too—the reboring of cylinders to any old size, instead of having a standard for rebored cylinders. This could be made ⅛ inch larger than original size in most cases. In many shops, however, the cost of reboring and fitting new piston head comes so near the cost of a new cylinder from the makers that the old ones can be scrapped to advantage. FRED G. HARTMAN.

Corning, N. Y.

Breakage of Air Pumps Valves.

Editor:

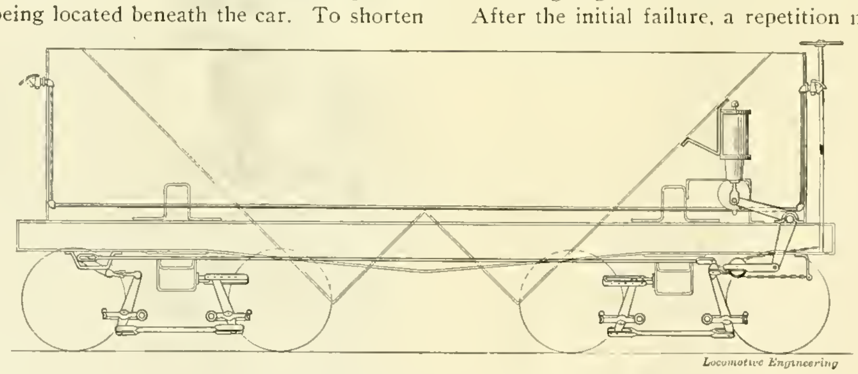
Referring to Question 121, it is true that with the 8-inch pump it is the lower discharge valve that breaks most frequently, and that it is the upper discharge valve with the 9½-inch. As you suggest, the cause is undoubtedly the greater amount of oil that reaches the valves in question over that going to the others.

After the initial failure, a repetition not infrequently results from the new valve having no contact with the seat except at the outer edge.

When replacing valves, the seats should be brought to the standard bevel of 45 degrees and the valve ground to a full bearing, thus reducing the rapidity of wear and decreasing the liability of breakage.

F. B. FARMER.

St. Paul, Minn.



A PATENTED BRAKE GEAR FOR HOPPER-BOTTOM CARS.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(123) G. U. E., Taunton, Mass., writes: In September number you say in regard to brake beam tests that the greatest increase in pressure was obtained when the brake was set, the slack taken and the forward start made. Wouldn't this taking the slack on trains with the brakes set tend to skid wheels? A.—Yes, unless the brakes were surely off when the start forward is made. In taking slack, the brakes should be set only lightly, otherwise wheels may slide as you say.

(124) X. Y. Z., Longview, Texas, asks: What defects will cause both train line and reservoir pressures to reduce together when an application of air is made, and brakes to release? A.—Since you do not say whether the trouble occurs with a train or light engine, we will assume it is with the latter. Probably the engine has the main reservoir on the rear of the tender, thus requiring three lines of hose couplings between the engine and tender, and these hose have been wrongly coupled up. There are also several combinations of improper piping and poor condition of air-brake apparatus that would cause the trouble mentioned.

(125) J. W. A., Toledo, O., writes: There are some of the rubber seats that we take out of the emergency valves that curl or roll up at the edges, and these rubber seats look like new. Older rubbers don't roll up. I notice that the trouble comes oftener with the rubbers with the big hole. Please say what the cause is, and why. A.—Some time ago the stem of the emergency valve was so changed as to require a rubber seat with a 5/8-inch hole, instead of the 3/8-inch as formerly used. The seats with the larger hole have also been used on the smaller stems by some repairmen, with the result that the stem doesn't fill the hole, and the rubber seat therefore curls up at the edges.

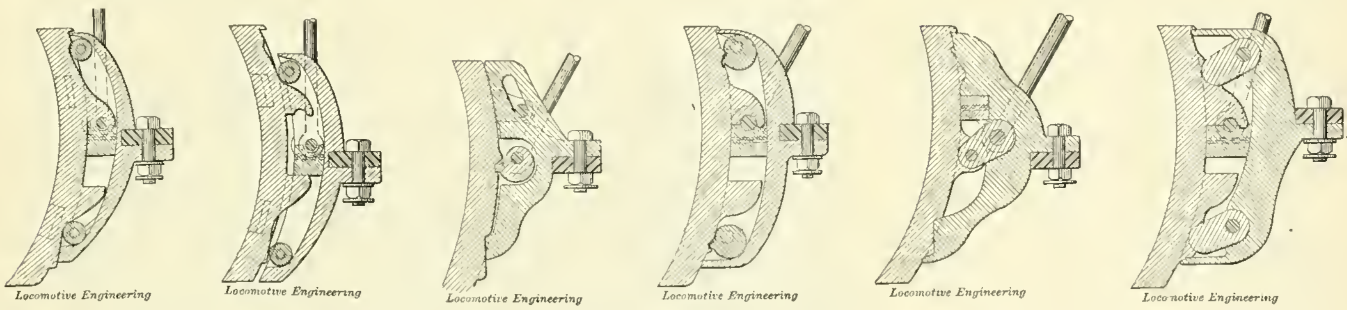
(126) B. C. G., Moncton, N. B., writes: Will you please inform me what is meant by the term "brake-burnt." It is claimed that wheels have to be removed occasionally from freight cars here from being what is called "brake-burnt." The term is something entirely new to me, and I am as a loss to understand the cause of it. Will you please enlighten me? A.—The term "brake-burnt" is used sometimes by trainmen—not, however, as to the air brake itself, but to wheels and shoes getting hot, or "burnt," as they say, either from the cause of improper use of the retaining valve or hand brake. Even engineers use the term sometimes when they refer to packing leathers in driver brake cylinders giving out.

(127) J. J. C., Brownsville, Tex., writes: If the old-style air-pump governor should be placed on steam pipe to pump in a reversed position—that is, with pump connected to the side of the governor that should be next to the boiler—would the pump go to work after once being shut off by the governor, or would steam from boiler hold steam valve of governor closed? A.—The size of the coupling nut and the threads on the two connections have been purposely made on all the governors so they could not be coupled up wrong end to. However, should a wrong connection be somehow made, the governor would not open after the steam valve had been seated, so long as the air pressure was above that for which the governor was set. However, should the air pressure leave the top of the piston and the steam pressure drop down very low, or the throttle be nearly closed, the spring would then be able to raise the valve off its seat.

(128) W. L., Indianapolis, Ind., writes: Why isn't the preliminary exhaust port in the engineer's brake valve made big enough before it is sent out to roads? Some of our valves here are drilled out larger. Some engineers say that the valve won't set brakes soon enough, after they have been set once, unless the port is made 1/8 inch in size. A.—This is all a bad mistake. The preliminary exhaust port is the right size when the valve is sent out. This port's diameter has been decided upon after careful experiment and long practice, and should not be changed. If it is enlarged, quick action is likely to be had when not wanted. The trouble you mention is caused by overcharging the train pipe after brakes are released, and not by the small diameter of the preliminary exhaust port. If more than one application is necessary in making a stop or slowdown, move the valve handle to full release for an instant only, then return to lap position, thus releasing the brakes and avoiding an overcharge of the train pipe.

(129) G. U. E., Taunton, Mass., writes: In your description of the brake beam tests in the September number, you say that when the air brake was set on the car that the dynamometer gage on the special brake beam registered 3,000 pounds. Then you say that the rods and levers under the car were shaken and that the gage ran up to 4,200 pounds, and when the car was started up you say that the gage ran on up to 5,250 pounds. I can understand how the wheel carrying the shoe upward would cause the increased gage pressure, but don't see how shaking the rods and levers would cause an increase. Please explain. A.—There is a great deal of friction in the pins of the rods and levers, which absorbs a very considerable part of the power sent out by the piston when the brake is gradually set. When the parts are shaken, however, the friction is broken loose, and the power which was temporarily detained and held in absorption passes on to the brake beam. In this case friction of the pins temporarily absorbed 1,200 pounds.

(130) A. B. J., Sandusky, O., writes: The air gage shows up correctly with 70 and 90 pounds with the light engine, but with train shows but 60 pounds train line and 80 main reservoir pressure. Am using F-6 (1892 model) brake valve and improved pump governor. Supply valve is all right. What is the cause? A.—Possibly your pump will supply only a limited amount of air, and the leakage from your train pipe is such that these pressures cannot be exceeded with the train. With the light engine, however, the train pipe leakage is almost nothing and the pump can, therefore, keep the pressure up. This would account for the 80 and 60 pounds pressure for main reservoir and train pipe respectively as you describe. Almost any F-6 (1892 model) valve will shut off train pipe pressure a few pounds lower than 70, for which it is set, when a very long train is had, but will shut off accurately at 70 with the light engine or short train. This is overcome in the new feed valve slide valve improvement, whose action in opening and closing the port is sudden and positive.



SOME RECENTLY PATENTED BRAKE SHOES.

Express Locomotive with Superheater.

The handsome eight-wheeler which we herewith illustrate is the latest type of German locomotives for fast passenger service, designed by the A. Borsig Locomotive Works, Tegel, near Berlin, Germany. The photograph and description are furnished by our friend Julius S. Jensen, who has recently become connected with these works as mechanical engineer.

This engine is equipped with superheater (patented by Wilhelm Smith, Wilhelmshöhe, near Kassel, Germany), of which the tubes are placed inside and two steam chambers outside the smokebox, one on each side the smokestack. We understand that the Canadian Pacific Railway, Montreal, are having five engines built equipped with this kind of superheater.

The general dimensions and description of the engine are as follows:

Engine:

Cylinders—19 11-16 x 23⅝ inches.

Driving wheels, diameter (Krupp's cast steel)—78 inches.

Engine truck wheels, diameter (Krupp's cast steel)—39⅜ inches.

Driving wheel-base—102⅜ inches.

Total wheel-base of engine—24 feet 4 inches.

Boiler, straight; diameter first course inside—54 inches.

Heating surface—Firebox and tubes—1,200 square feet; superheater, 300 square feet.

Grate area—24.5 square feet.

Working pressure per square inch—171 pounds.

Weight on drivers—72,500 pounds (English).

Weight on truck—52,000 pounds (English).

Total weight of engine in working order—124,500 pounds (English).

Westinghouse air-brake equipment.

Tender:

With six wheels; wheel diameter—39⅜ inches.

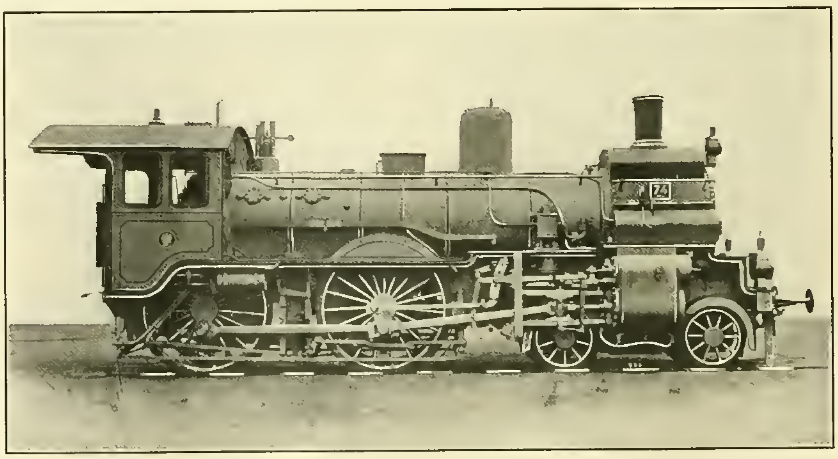
Water capacity—3,200 gallons.

Coal capacity—5 tons.

The superheater consists of sixty tubes, 1 3-16 inches inside diameter and 1½ inches outside diameter, placed in the smokebox and bent concentric, three together in each row (twenty rows). The tubes form an inside wall in the smokebox, but with small spaces. The upper end of the twenty rows of tubes is connected to two steam chambers, of which one is placed on the right and one on the left side of the smokestack, outside the smokebox. The twenty inside tubes are below, bent in the shape of an arch, and form a chamber (superheater box). A 10-inch tube is riveted to the rear and front flue sheets below the boiler flues. The flames and gases passing through this tube enter the superheater box in the smokebox, which, together with the tubes in the smokebox, are cased with plate iron formed to the shape of the inside row of tubes, running up right and left and covering the ends of the tubes connected to the steam chambers. In each side of the iron casings is a damper which is operated from the cab.

The steam chamber on the right side has a partition in the middle. In the rear part of this chamber the wet steam enters from the throttle and passes through the ten rear rows of tubes and then into the left steam chamber. The left steam chamber has no partition, and the steam now passes through this chamber and through the ten front rows of tubes of the superheater to the front part of the right steam chamber. Being now heated to about 570 degrees Fahr., the steam passes through the steam pipes to the steam chest in the usual manner. The fall of temperature of the gases from the boiler tubes to the smokestack is about 1,470 degrees Fahr., and is sufficient to heat the wet steam from 375 degrees to 625 degrees Fahr. The tests with this locomotive equipped with superheater showed very good results. The superheated working steam, on the average 570 degrees Fahr., saves about 25 per cent. of coal and about 33 per cent. water over the ordinary locomotive using wet steam.

The builders, A. Borsig, Tegel, near Berlin, Germany, have just been rewarded with the highest prize (Grand Prix) from the Paris Exposition for this locomotive.



EXPRESS LOCOMOTIVE WITH SUPERHEATER.

The Shirt Waist Man on Railroads.

The shirt waist man has been giving trouble to the railways. Some roads have requested him to put on his coat or retire to the smoking car. One prominent road, after consulting its attorneys on the question issued the following circular:

"To all passenger conductors: A lady riding in one of our coaches took offence at the presence of a man who insisted upon riding in the ladies' car with his coat off. This matter was submitted to our legal department as to what the action of our conductor should be under the circumstances.

"This is one of the cases where it seems that discretion must be left to the conductor. So long as a man is decently dressed, whether he has a coat on or not, his appearance cannot be offensive to any sensible person, and as one of our objects is to provide for the comfort of our passengers I do not see why, on purely academic grounds, we should object to it. The conductor, however, is the person to determine this. Where he sees that a man by removing his coat effects an offensive attitude, he ought to suppress that man promptly. But if no such offence is given I do not think that he should interfere."

Mining Activity in the Black Hills.

There is considerable mining activity in the Black Hills, and a number of new mines are being opened up. Comparisons made between the present condition of mining in the Black Hills and that of Colorado, Idaho and other Western precious-metal States are not at all unfavorable to the former. Last year upward of $8,000,000 was taken from Lawrence County mines, one of them being the Homestake. There is said to be not more than one stamp mill standing idle in the county. And yet the Black Hills mining industry can be said to be practically in its infancy, for their are great areas which will ultimately prove of great productiveness that yet remain unnoticed and unexploited.

The Brown & Sharpe Manufacturing Company, Providence, R. I., have issued a neat pamphlet for distribution at the Paris Exposition. It gives a brief history of their establishment in 1833 and shows their growth up to the present. It also shows the development of their machines and tools and makes a very interesting little booklet.

In European "corridor" (vestibule) cars they employ a movable door to close the last corridor opening. When they put on on extra car the door is taken off and carried back and secured to the hind end of the car last put on. Looks like an awkward arrangement.

Setting Piston Valves.

As there are now many piston-valve engines in use in this country, the question of setting them properly and easily is quite an important one, as numerous inquiries on the subject have indicated. It is easy to tell a man that the action is the same as in a plain slide valve (except, of course, where the piston valve has internal admission, when the motion is exactly reversed); but a few points from men who are familiar with piston-valve practice is of more value.

Knowing that Mr. George R. Henderson, of the Chicago & Northwestern road, has given considerable attention to the piston valve—as evidenced by his patent relief valve, mentioned elsewhere—we were glad to secure his method as described below. Mr. Henderson says:

"In my practice with piston valves, I have always used a peep-hole, about 1¼ inches diameter, so located that you could look directly down into the cylinder port and see the cutting-off edge of the port, and consequently the valve as it passes it. This hole is covered with a brass plug during use of the engine, and is only removed when necessary to examine or reset the valves. The valves under these circumstances can be examined at any time, not only for the proper lead and cut-off, but to see if the rings are broken. The process is about as follows for valves with central admission:

"The valve can be fitted up and put complete in the cylinder with the head and casing applied without taking any preliminary measurements, providing, of course, the valve and bushings have been finished to the drawing. When ready to set the valve, remove all the plugs above referred to and insert in one of them a lighted taper or a thin torch tube. This will illuminate the opening in the bushing forming the edge of the port, and by moving the valve until the internal edge of the packing rings comes against the cut-off edge of the port, the exact position of the valve for cut-off or admission can be distinctly seen. With the valve in this position, make the regular scribe marks on the stem. Repeat the operation at the other end of the cylinder and you have the two scribe marks on your valve stem for front and back admission. The rest of the process is identical with the setting of any slide valve and does not need any further description.

"With valves of external admission, I think it preferable to use holes as above explained, particularly on account of the ease of being able to examine the adjustment of the valve at any time without disconnecting or removing the cylinder heads or smaller parts; but the valve can be scribed before the heads are put on, by simply looking in the ends of the valve chamber and seeing where the edge of packing rings comes against the cut-off edge of the port."

MOUNT WATKINS, YOSEMITE VALLEY, ALONG THE SUNSET ROUTE.

Running a 4,000-mile Railway Without Coal.

CONCISE ACCOUNT AS TO COAL IN SIBERIA, ALONG THE TRANS-SIBERIAN RAILROAD.

From time to time magazine and newspaper articles on Siberia tell that the "coal mines are practically inexhaustible." "It [the coal] even crops out at the surface here and there," only awaiting "the advent of the locomotive to turn the desolate wilds into teeming hives of industry," etc.

The Trans-Siberian Railroad is on the verge of completion, with some 4,000 miles in actual operation, but not a pound of coal is being used or mined for the operation thereof, nor even for private local use, nor is there any likely to be for many a year to come. We have the unique spectacle of a gigantic trans-continental railroad being operated, so far, without the consumption of a pound of coal. With the railroad entirely finished, the remarkable feature will be presented of a 5,000-mile railway and branches operated without coal. It is a case without parallel in the history of railroad engineering.

The fuel used is wood—wood throughout—from the Pacific Ocean to the Ural Mountains. The locomotive tenders are specially constructed to carry the big pile of wood—the tender being "stacked in" high to prevent the wood-pile disintegrating when the train is in motion. This wood-pile will sometimes almost reach a height equal to that of the smokestack. But one disadvantage of the wood for fuel is that it requires double the amount of space for storage for a 100-versts run than would be needed if coal were used; while its bulk is more, its weight is less than the mineral, so that as far as dead-weight is concerned, the two fuels come out about equal. Wood certainly has in its favor cleanliness; and you never hear the "soft rain of ashes" on the car-roof, as in America.

Conversing on wood and coal with Russian locomotive engineers and firemen —men who had had many years of experience with both fuels while in Russia proper—opinions seemed to be equally divided on the choice of the two fuels, with, however, a tendency in favor of wood.

As to coal in Siberia, the writer will briefly give the results of his own observations on the spot, having employed a year's time in inspecting all that was worth visiting. Coal there is, it is true, but I failed to learn from any of the couple of thousand of Russian officials, 200 of them being qualified civil or military engineers, that at any place it "cropped out at the surface." Where coal was known to exist—the officials being dubious as to its extent and worth—it was at no place near enough to the railroad to be utilized advantage, whereas the almost impenetrable forest sided the lines for thousands of miles. The timber had to come down, so that Russian emigrants could have spaces to cultivate—thus a double purpose being served, land cleared and fuel provided; and coal could not be mined, to successfully compete with wood fuel, for many years to come—even if then.

If a dozen or score years hence (assuming that in the meantime the trans-Siberian Railroad has not degenerated into an historic "two streaks of rust" 5,000 miles long; for that is its possible fate with the construction by other powers of more southerly trans-Asiatic railway systems)—if a dozen years hence the wood supply does become exhausted, it would be cheaper to operate the railroad with the refuse petroleum product of Baku, in South Russia, than to use coal. For western and central sections of the line, petroleum-fuel trains can reach their destination in a week or ten days; for eastern Siberia and Manchuria, tank-steamers would carry the fuel half round the globe (*via* Suez, Singapore and Vladivostok) in five or six weeks.

Coal is placed at a decided disadvantage on many Russian railroads by the competition of the refuse petroleum product. The fetid stuff already taints the fair air of the Ural Mountains with its fumes. We all know the objection to the odor of the kerosene fume from the most "civilized" domestic lamp; but imagine the half-decomposed odor of the smoky fumes from an ill-burning Russian locomotive! It's exquisite!

Yet the filthy refuse petroleum, compared to which coal is cleanliness itself, has one all-redeeming feature, so far as the handling thereof is concerned, and that is, the facility and celerity with which it can be used. So regularly can it be fed to a furnace, and to such a nicety, that the services of a fireman are almost dispensed with. I have often noticed, in fact, during trips on oil-burning engines, that the drivers have a penchant for doing the firing themselves, which, however, is no greater hardship than an occasional squirt at the furnace, and the slightest touch at the oil injector.

To give an idea of the extreme celerity with which petroleum fuel can be handled, I will cite a simple illustration. All the big steamers on the Volga are petroleum-fueled. I used to watch the quick work of refilling the steamer's oil tanks from the petroleum reservoirs on rafts moored to the river's edge. The oil is run by gravity from the reservoir down the slide into the steamer's tanks. Were coal the fuel used, it would take half-a-dozen hours (by the native hand-carrying methods) to refill the coal bunkers for the long run; and it took to refill with petroleum exactly three minutes!

Then it must not be forgotten that the oil required but a third or a quarter the space that coal would have occupied; there is never any dust in loading; no refuse-ash to haul out, as with coal; while any expert on fuels will inform you that 1 ton of oil is equivalent to 2 tons of coal.—L. Lodian, in *Coal Trade Journal.*

HALF DOME AND CLOUD'S REST, YOSEMITE VALLEY, ALONG THE SUNSET ROUTE.

The long, dark evenings that are upon us give plenty of time for study. Those who wish to have good books to study should send for our "Book of Books."

Personal Department.

Mr. S. F. Nixon has been elected vice-president of the Jamestown & Chautauqua Railroad.

Mr. C. O. Mikle has been appointed general foreman of the Delaware, Lackawanna & Western at Buffalo, N. Y.

Mr. N. E. Sprowl has been appointed master mechanic of the Southern Railway, with headquarters at Columbia, S. C.

Mr. G. H. Mathews, division foreman of the Chicago & North Western, has been transferred from Eagle Grove to Lake City, Iowa.

Mr. A. E. Tremp has resigned as master mechanic of the Ohio Southern, and will be succeeded by Mr. S. W. Crawford; headquarters, Springfield, Ohio.

Mr. J. L. Mohun, master mechanic of the Pennsylvania Railroad at Lambertville, Pa., has resigned, and will be succeeded by Mr. W. B. Page.

Mr. Geo. T. Jarvis, receiver and general manager of the Louisville, Evansville & St. Louis, has been appointed general manager of the Wisconsin Central.

Mr. F. P. Hickey, master mechanic of the Rocky Mountain shops of the Atlantic Coast Line, has been transferred to the Manchester terminal as foreman.

Mr. J. J. McCann has been appointed trainmaster of the Scranton division of the Delaware, Lackawanna & Western, with headquarters at Scranton, Pa.

After September 1st Mr. Nat. C. Dean will no longer represent the Carbon Steel Company, but will continue his connection with the Lowe Brothers Company.

On September 1st Mr. W. R. Johnson resigned the position of master mechanic of the Pennsylvania division of the Delaware & Hudson at Carbondale, Pa.

Mr. M. H. Hubbell has resigned the position of master mechanic of the Peoria & Pekin Terminal. Mr. M. C. Draper will succeed him; headquarters, Peoria, Ill.

Mr. Richard English, division master mechanic of the Rio Grande Western at Helper, Utah, has resigned and accepted a position with another road in California.

Mr. B. A. Gibbs has been appointed master mechanic of the Mason City & Fort Dodge, vice Mr. E. H. Maute, resigned; headquarters, Fort Dodge, Iowa.

Mr. J. M. Graham has been appointed master mechanic of the Boston & Albany, in place of Mr. E. Priest. Mr. Graham's headquarters will be at Rensselaer, N. Y.

Mr. M. N. Diefenderfer has been appointed general foreman of the New York, Susquehanna & Western shops at Stroudsburg, Pa., vice Mr. J. W. Oplinger, resigned.

Mr. G. E. Pryor, general foreman of the Buffalo & Susquehanna at Galeton, Pa., has left there to assume a similar position on the Delaware, Lackawanna & Western at Utica.

Mr. J. G. Mackendon, master mechanic of the Little Rock & Hot Springs Western at Hot Springs, Ark., has resigned, and Mr. George W. French has been appointed in his place.

Mr. E. M. Rine has been promoted from the position of trainmaster of the Delaware, Lackawanna & Western to that of acting superintendent of the Scranton division, with office at Scranton, Pa.

Mr. C. E. Slayton has been appointed master mechanic of the Virginia Iron, Coal & Coke Company. Mr. Slayton already holds a similar position on the Virginia & Southwestern at Bristol, Tenn.

Mr. Robt. Rennie has resigned as general foreman of the Lehigh Valley to accept the position of master mechanic of the Delaware & Hudson at Carbondale, Pa., vice Mr. W. R. Johnson, resigned.

Mr. Chas. Wigglesworth, brakeman and extra conductor of the Rio Grande Southern, has been promoted to the position of roadmaster of the second district of that road, with headquarters at Durango, Colo.

Mr. W. I. Allen has been appointed general manager of the Cincinnati, Richmond & Muncie, with headquarters at Richmond, Ind. He was formerly assistant general manager of the Chicago, Rock Island & Pacific.

Mr. C. C. Robinson has been appointed master mechanic of the Illinois Central at Mattoon, Ill. Mr. Robinson was formerly master mechanic of the Peoria, Decatur & Evansville, which road has been absorbed by the Illinois Central.

Mr. F. W. Cox, general foreman of the locomotive department of the Chicago, Milwaukee & St. Paul at West Milwaukee, has resigned to accept a position with the mechanical department of the Baltimore & Ohio at Baltimore, Md.

Mr. Chas. A. Beach has been appointed superintendent of the Atlantic City division of the Philadelphia & Reading. Mr. Beach was formerly superintendent of terminals of the Central Railroad of New Jersey at Jersey City, N. J.

Mr. R. A. Camper has resigned his position with the Lima Locomotive & Machine Company to accept one as foreman of the copper and pipe-fitting department at the new shops of the Lake Shore & Michigan Southern at Collinwood, Ohio.

Mr. J. L. Forepaugh has been appointed assistant superintendent of the Northern division of the Great Northern, in place of Mr. B. F. Egan who has been promoted. Mr. Forepaugh's headquarters will be at Grand Forks, N. Dak.

The office of forwarding agent of the Lehigh Valley at Packerton, Pa., has been abolished, and all business pertaining thereto will be handled by Mr. R. F. Gould, general yard master, Packerton. The position of general forwarding agent of this road has been entirely abolished.

Mr. C. J. Phillips has been appointed general agent at Bangor, Pa., for the Delaware, Lackawanna & Western, in charge of the operation and traffic of the Bangor & Portland, acquired by the Lackawanna. Mr. Phillips was formerly division freight agent of the Rock Island at Des Moines.

Mr. H. Swoyer has been appointed master mechanic of the Florence shops of the Atlantic Coast Line, to succeed Mr. D. J. Justice, who has been appointed general inspector of the entire system. Mr. Justice was formerly acting master mechanic, and Mr. Swoyer general foreman of the Florence shops.

Mr. W. J. Hartman has resigned his position of air-brake inspector on the Big Four system to accept a position as road foreman of engines and air-brake instructor on the Chicago, Indianapolis & Louisville Railroad, with headquarters at La Fayette, Ind. Mr. Hartman's successor has not yet been named.

Mr. G. P. Sweeley has been appointed master mechanic of the Northwest system of the Pennsylvania lines at Allegheny, Pa., to take the place of W. F. Beardsley, who has been transferred to the same position at Crestline, Ohio. Mr. Beardsley succeeds Mr. J. D. Harris, who is transferred to Wellsville, Ohio.

Mr. George D. Wadley has been appointed vice-president and general manager of the Waycross Air Line, with headquarters at Waycross, Ga. Mr. Wadley was at one time general superintendent of the Central of Georgia, but for some years past has been superintendent of construction for the Mexican National.

Mr. Angus Sinclair, editor of Locomotive Engineering, has accepted the appointment of consulting engineer for Great Britain and America for Barbey & Co., Switzerland. Barbey & Co. are erecting large works in Switzerland for the construction of railway machinery and electric street cars. The works are situated at La Croix, where there is fine water-power. The shops are to be under American management and will be equipped with American tools.

Mr. Geo. D. Brooke has resigned the presidency of the Northwest Railway Club, and at the September meeting Mr. E. A. Williams, mechanical superintendent of the Soo Line, Minneapolis, was elected to fill the position. List of officers is now as follows: President, E. A. Williams, mechanical superintendent, Soo Line, Minneapolis; first vice-president, A. Lovell, superintendent motive power, Northern Pacific Railway, St. Paul; second vice-president, G. H. Goodell, mechanical engineer, Northern Pacific Railway, St. Paul; secretary and treasurer, T. A. Foque, assistant mechanical superintendent, Soo Line, Minneapolis; assistant secretary, F. B. Farmer, Westinghouse Air-Brake Company, St. Paul.

Mr. E. G. Russell who has been general superintendent of the Delaware, Lackawanna & Western, has resigned to become general manager of the Rutland Railroad, with headquarters at Rutland, Vt. Previous to his connectoin with the Delaware, Lackawanna & Western, he was for a number of years with the Illinois Central as assistant superintendent, division superintendent and superintendent of transportation, leaving in 1893 to accept the position of superintendent of the Rome, Watertown & Ogdensburg. He remained with this road until 1899, when he resigned to accept a similar position on the Delaware, Lackawanna & Western. After holding that position for three months, he was appointed general superintendent.

Mr. P. M. Hammett, who has lately been appointed assistant superintendent of motive power of the Boston & Maine, with headquarters at Boston, is one of the numerous mechanical railway officials who got an apprentice training in the Altoona shops of the Pennsylvania Railroad. He was born in 1867 and graduated from Harvard College in 1888, and from the Massachusets Institute of Technology in 1890. From there he went to Altoona, where he remained a little more than three years, and then was appointed general foreman of the Wilmington shops of the Philadelphia, Wilmington & Baltimore. In 1896 he accepted the position of division master mechanic of the Boston & Maine, and now has gone to the higher position.

Mr. John W. Oplinger, for the past seven years general foreman of the New York, Susquehanna & Western shops at Stroudsburg, Pa., has resigned to accept the position of master mechanic of the Atlantic Coast Line shops at South Rocky Mount, N. C. As a token of the great love and respect in which he was held, the shop employés presented him with a handsome desk outfit and a smoking set. The presentation speech was made by Mr. J. G. Ward, and was feelingly replied to by Mr. Oplinger. On the following evening he was tendered a farewell banquet by the shop employés, at which Mr. J. C. Sullivan, on behalf of the engineers, presented him with a fine gold watch as a mark of their appreciation of his services. He leaves a host of friends who wish him success in his new position.

Mr. T. E. Clarke, who a short time ago was appointed a division superintendent of the Delaware, Lackawanna & Western, has been advanced to the position of general superintendent, with headquarters at Scranton, Pa. Mr. Clarke entered railroad service as a telegraph operator in 1865 on a railroad in Indiana. For the next twenty years he gained a great deal of railway experience, having been train-dispatcher, superintendent of telegraphs, master of transportation and superintendent. In 1883 he became superintendent of the Minneapolis & St. Louis, and shortly afterwards was advanced to general superintendent. Mr. Clarke was one of the most popular railroad officials in the Northwest, and we are persuaded that he will fulfill the difficult duties of his new position with satisfaction to all.

Mr. William Gibson, who has been for several years general superintendent of the Baltimore & Ohio at Pittsburgh, has been advanced to the position of general superintendent of transportation, with headquarters in Baltimore. Mr. Gibson began railway work in Scotland, and came to this country about twelve years ago and went to work as car service agent on the Columbus, Hocking Valley & Toledo. Then he went to the Big Four as chief clerk to the general manager, where he rose to be a division superintendent. Five or six years ago he entered the service of the Baltimore & Ohio, and has been steadily rising. He is a man of strong individuality and possesses the characteristics that make an official popular with high and low, with superiors and subordinates. At Pittsburgh he distinguished himself by securing business that the company had never been able to touch before.

MR. B. R. LACY.

An Engineer as Labor Commissioner.

Not so many years ago a regular delegate to the Locomotive Engineers' conventions was Mr. B. R. Lacy, who was an engineer on the Atlantic Coast Line and hailed from Raleigh, N. C. Mr. Lacy was a natural leader, and there were always duties that he was called upon to perform, which made his face and voice familiar to the delegates. Seven or eight years ago he was nominated as Labor Commissioner, and elected, which took him out of railroad service. The writer has always kept up a fugitive correspondence with Mr. Lacy, and was pleased lately to receive a photograph of his friend, with the following letter:

"Thinking you might desire to see the face of the first mechanic that the Democratic party has ever put on the State ticket, I enclose you my photograph. My majority was about twice as large as any treasurer of this State ever received before. I received 186,499 votes. Governor Aycock lead me by 151, he receiving 186,-650. The salary is low, considering the bond of $250,000, but it is the maximum. It is the same as the Governor's ($3,000) and larger than the Supreme Court Judges'. It is for four years and a hoped-for re-election, while the Constitution does not let the Governor hold but one term.

"I read LOCOMOTIVE ENGINEERING with more interest, if anything, than I did when on the road."

President Stevens to Remain.

Insistent rumor has had it that George W. Stevens is soon to retire from the presidency of the Chesapeake & Ohio, and thereby make way for an executive officer of the Pennsylvania Railroad, which has obtained control of the Chesapeake & Ohio. Officers of the Pennsylvania say, however, that there is no truth in the report. They say, further, that President Stevens' administration of the Chesapeake & Ohio is eminently satisfactory to the owners, and that he will therefore remain in his present position for some time to come.

We recently saw one of the old multiple exhaust nozzles patented by Thomas Shaw, in about 1877. This had eighteen 1½-inch tubes in about a 12-inch circle, with the end drawn down to an inch opening; giving a total area of approximately 14 square inches. As it is for a switcher it will probably answer.

Charles Graham.

Charles Graham, for many years master mechanic of the Delaware, Lackawanna & Western Railroad, died at Scranton last month. Mr. Graham was at one time among the best known railroad mechanical men in America, and he put a mark on the anthracite-burning locomotive that others have reaped the credit of.

Mr. Graham was born at Dunfermline, Scotland, in 1834. After learning a branch of the machinist trade, he came to the United States when he was nineteen years old, and went to work at once in the Rogers Locomotive Works at Paterson, N. J. Two years later he went to Scranton to work in the shops of the Syracuse, Binghamton & Susquehanna Railroad. A year afterwards he was made foreman, and then rose quickly to be master mechanic.

At that time the company was using wood for fuel, although the railroad traversed the richest anthracite coal regions in Pennsylvania. Numerous attempts had been made to burn anthracite coal in locomotive fireboxes, particularly by Millholland on the Reading Railroad, but the efforts were not much of a success. Zerah Colburn had designed an engine with a wide firebox extending over the frames, with a view of providing the large grate area necessary for burning anthracite coal. Railroad men, as a rule, did not like that form of firebox, but Mr. Graham perceived its possibilities and he gave it a trial, devoting close personal attention to its performance. He effected a variety of improvements on the firebox, and it became a decided success for the burning of anthracite, and is still largely used by the road. The people call that form of firebox the "Mother Hubbard."

Towards the end of the seventies Mr. Wootten, of the Philadelphia & Reading, put a combustion chamber in a Colburn firebox and secured a patent on the combination. A company was formed to push this patent, and it was exploited under the name of the "Wootten firebox." This was done so effectually that to-day all fireboxes extending over the frames are spoken of as Wootten, although most of them are merely Colburn fireboxes with Graham's improvements.

Thirty years ago Mr. Graham was considered one of the ablest mechanics in railroad service. He was urged to take the position of superintendent of the Rogers Locomotive Works, and other prominent railroad positions were offered to him, but he refused to leave Scranton. In 1882 he met with an accident while he was clearing away a wreck, which shortened his usefulness and his life. He was struck in the back, and the blow caused injury to his spine. He struggled about till 1890, when he lost the power of walking. Throughout the long years of suffering that followed he displayed wonderful cheerfulness, and was celebrated for the interesting reminiscences with which he entertained old friends who often visited his pleasant household. Mr. Graham was an honorary member of the Master Mechanics' Association. He joined at the second meeting, and for years took an active part in the work carried on.

The poor locomotive began having a hard time of it before it got fairly started. As early as 1834 there was a talk of "atmospheric locomotives" in France, which were to send the steam locomotive to the scrap-heap. Seems to us we have heard similar statements in the last few years—but the locomotive works are busy yet.

Ferry Officials Hoodwinked.

There is a law which prohibits the carrying of gasoline by automobiles on New York ferryboats. When one of these machines runs on to a ferryboat an inspector opens the drain cock in the gasoline ank to see if the law is being complied with. Some automobilists escape the inconvenience by having a false cock in the tank. Others stop up the cock. The latest scheme for fooling the ferry officials, however, is to have a can, shaped and painted to resemble a dress-suit case. Before going on to the ferry, the footman or motorman draws off the gasoline from the automobile tank into the innocent-looking suitcase and carries it with him into the ladies' cabin. When the opposite side of the river is reached, the gasoline is emptied back into the tank of the machine, and the hoodwinked ferry officials are not aware that the law has been broken.

MR. CHARLES GRAHAM.

Steam Reverse Gears for Large Engines.

BY JOHN W. TROY.

Locomotive engineers are very well aware that in a number of accidents in which the engine has turned over, the engineer has been fastened down by the reverse lever and scalded, or so badly injured that his death was the result. The question comes up: If the reverse lever is such an element of danger in the case of a collision or derailment, why cannot it be arranged to be out of the way in such a case? Steam reverse gears can be applied outside of the cab to do the work of raising and lowering the links, with a suitable lock to fasten the lever, just the same as the lever is now fastened to the quadrant; or the quadrant can still be left in the cab and the locking dog be operated by the foot. This would leave the whole arrangement below the level of the knee or in the running board.

On the large engines the boilers are so wide that there is very little room for the engineer between the side of the boiler and the cab. The cab cannot be made any wider, for it is now as wide as a sleeping car, or out against the clearance limits.

Some such a reverse gear would make more room on the engineer's side of the cab, make it easier and quicker to handle the large engines and make them less dangerous.

If a reverse lever was needed to handle the engine when she did not have steam on, it could be attached in much the same manner as the shaker-bar is now attached to move the grates with a socket bar.

Ordinarily, when an engine is moving, the steam pressure would be available to do the work of reversing.

If some of our engine designers whose boilers lack only 12 or 14 inches of filling the cabs sideways, would look at this matter from the engineer's standpoint, there would be immediate relief.

Officers of Locomotive Firemen's Brotherhood.

On September 22d the election of officers was made by the Brotherhood of Locomotive Firemen in their convention at Des Moines. All of the grand executive officers were re-elected, and there were few changes made on the boards. By unanimous vote, Grand Master Sargent was re-elected and his salary raised from $3,500 to $5,000. It was only on this condition that he would accept office. He has been grand master for fifteen years. Other officers were re-elected as follows: J. J. Hannahan, first vice-grand master; C. A. Wilson, second vice-grand master; Charles W. Maier, third vice-grand master; F. W. Arnold, grand secretary and treasurer; William S. Carter, editor of magazine.

Two Firemen for Monster Locomotives

It is reported that the firemen on one of the Western lines have requested their road to employ extra firemen on the monster new locomotives. This request is reasonable and should be granted. At present there appears to be no limit to the size and weight which the modern locomotive approaches; but the fireman has a limit. He cannot increase in size and strength to keep up with the growing locomotive. If he could, the fireman's column on the roundhouse board would not hold the names of Smith, Brown and Jones, but would have instead those of Samson, Goliath, Sandow and Jeffreys.

Reina Mercedes to be a Receiving Ship

The former Spanish cruiser "Reina Mercedes," sunk in the sea fight off Santiago and afterwards raised and towed to the Norfolk Navy Yard, has been declared unfit for active war service. The Navy Department has therefore ordered the "Reina Mercedes" to be taken from Norfolk, where she has been anchored since her arrival from Santiago, to Portsmouth, N. H., where she will be used as a receiving ship.

An Old Frame Fastening.

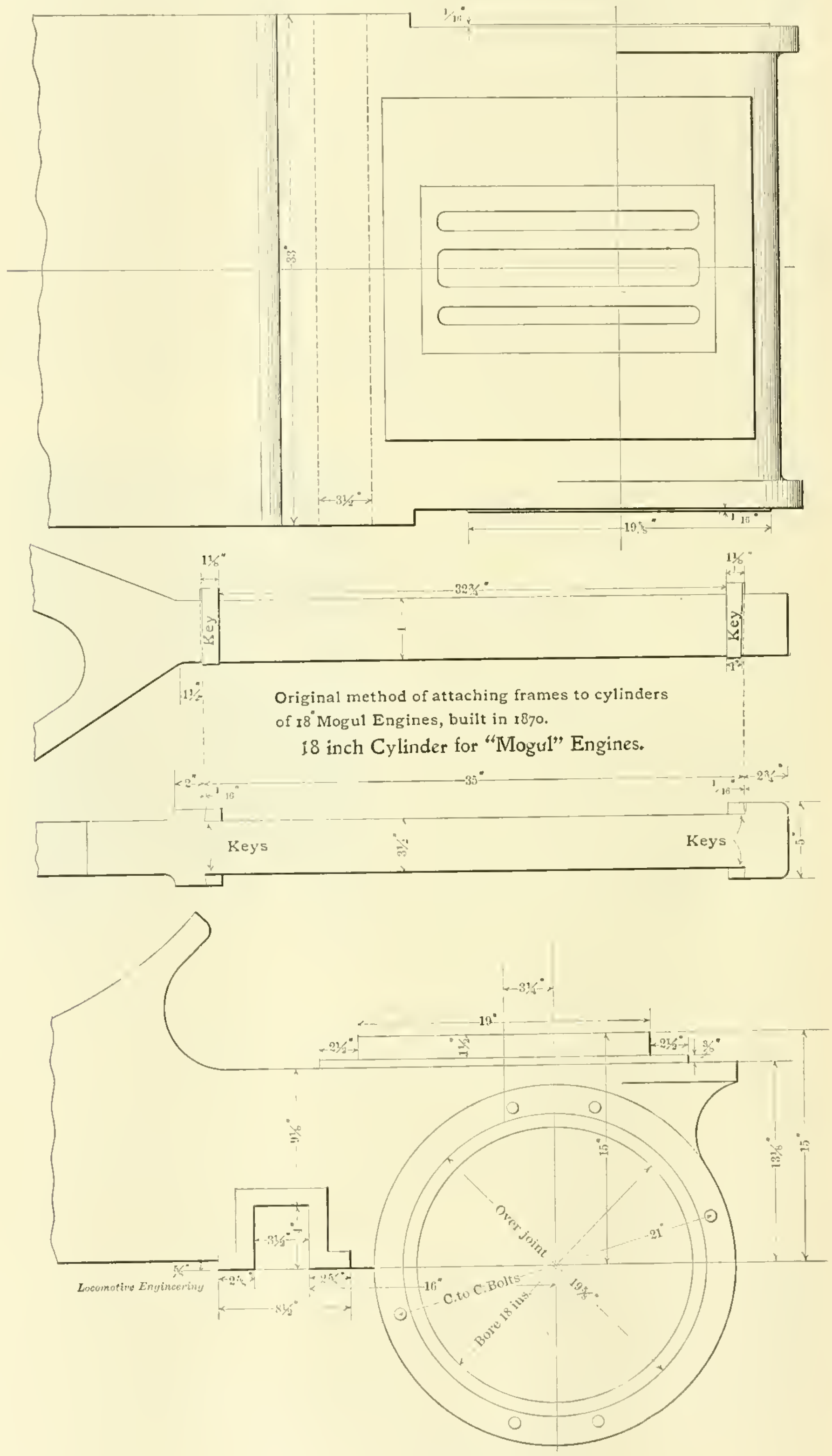
While the frame fastening of the rebuilt Philadelphia & Reading engine was new to most of us, the plan used by Mr. Thatcher Perkins, of "Perkins ten-wheeler" fame, was very similar to it, as the illustrations show.

Knowing that there had been something like this used on the Louisville & Nashville road in the old days, we wrote Mr. Pulaski Leeds, and received the following reply:

"Referring to yours of August 16th, relative to the fastening of cylinders adopted by Thatcher Perkins, while we use this method at the present time where we use old frames, and in fact where we use new, with the exception that we put the lugs for the keys on top of the frame. At the same time I thought best to get prints of as old tracings as we had and let you prepare anything you wanted to use and make cuts of it. Consequently, I give you print of cylinder as originally made by Thatcher Perkins in 1870—that is, you understand that they had no prints at that time, but this print was afterwards taken from the original drawing by Mr. Wells in November, 1881. These frames are forced up into the pocket shown on the underside of the saddle, and a plate about 8 inches square put under each end of the saddle, with four studs to each. I do not know how long Mr. Perkins had used this before the drawing referred to was made, but the date of that drawing is 1870, and these Moguls were built between that and 1873.

"P. LEEDS,
"S. M., Louisville & Nashville Ry.
"Louisville, Ky."

The drawings show the frame to have been 3½ by 4 inches, and the keys about an inch wide by ¾ inch thick. They have evidently given good satisfaction or they would not use practically the same method to-day.



PERKINS FRAME FASTENING, 1870.

The Evening School of Electricity under the direction of the Harlem Branch of the Young Men's Christian Association, at No. 5 West 125th street will open for its third season during the first week in October. The school will be in charge of Mr. S. A. Small, assistant instructor in electricity at Columbia College, and a man who is thoroughly practical from every standpoint, having seen active service in every branch of electrical work. The sessions will be held on Tuesday and Friday evenings, and the course will consist of forty-eight lectures. Mr. Small will commence by thoroughly grounding the class in the fundamental rules and principles of electrical engineering, and during the course will cover fully the various branches of telegraphy, telephony, police and fire alarm telegraphy, arc lighting, alternating current apparatus, the distribution of electrical power, the electric street railway, the electric automobile, the "X" rays and wireless telegraphy.

Ahead of the Record.

The Baldwin Locomotive Works is ahead of its record and also of its rated capacity to turn out 1,000 locomotives a year. This means a trifle under 20 a week the year round, or over three complete engines a day—an output that we can scarcely realize.

A recent visit showed a record for the week of 29 engines completed and sent through the erecting shop and 31 more ready for trial. If all of these are turned out complete the following week it will make an even higher record than the other.

Taking the average weight of the engines as 50 tons each, and it makes a total of 1,450 tons or 2,900,000 pounds as a week's work.

The immense amount of work in handling such a weight of material as well as the fuel and waste stock, takes a most thorough organization.

The Firemen's Convention.

The Brotherhood of Locomotive Firemen held their last biennial convention or Grand Lodge meeting at Des Moines, Iowa, beginning September 10th.

As might be expected from their occupation, a large majority of the delegates are young men whose natural bent is towards progress and better knowledge of their trade, which is fast coming up to the dignity of a profession.

One of these meetings is a great educator. While of course the business of the organization and legislation that will be of benefit to the body at large is the chief topic of conversation, yet they talk of their work on the engines as well. Men meet there from all parts of America who work under different conditions with different classes of locomotives and different grades of coal to burn. An interchange of opinions and description of methods which have been successful help everyone; for this interchange brings out new ideas at every gathering, which are discussed in all their bearings.

A quiet discussion of practical ideas always tends to broaden a man's mind, and makes him more valuable in every way; an acrimonious debate will only work on the passions and not on the reasoning powers.

At these meetings there are always men who are born leaders. If their gifts are of a class that will elevate and educate their fellows, their influence is permanent; if the other way, their career is short.

While in attendance at the meeting we met hundreds of friends of LOCOMOTIVE ENGINEERING, who appreciate its work. To all the members of the organization we extend a cordial greeting, and hope that our intercourse in the next two years may be pleasant and profitable to us all.

Draft Appliances.

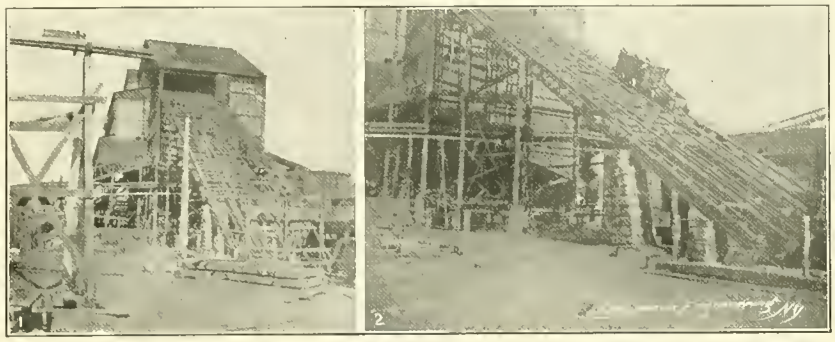
Why don't she steam? you ask.

There are so many possible answers to this question that it would take all day to go over them and at the same time explain the remedies for the defect. We do not think that any one man is able to give remedies for all cases of trouble with poor steaming engines.

In many cases the boiler is steaming very well, but the valves and cylinders are using the steam faster than the boiler can possibly make it. If you are using a large amount of water in proportion to the work done by the engine, do not lay the blame on the boiler, unless you are sure that it is priming and water is passing over into the cylinders in the form of spray; that is the fault of the boiler rather than the cylinders. If the steam passes over dry and there are no leaks of steam or water around the boiler or steam pipes, an extravagant consumption of water shows that the valves and cylinders are the offenders. In such a case hunt up the trouble; it may take an indicator card showing the faulty distribution of steam or the leaks past valve or piston to prove it to the machine shop and roundhouse man, but he can be convinced if you make a good showing.

No boiler can make steam enough to do the work economically unless the steam is used economically after it is made.

Even if the valve motion is all right and no leaks anywhere, the engine can be so handled as to waste steam and thus drain the boiler beyond its power. Working the engine cut back close to the center with a heavy train at a slow speed wastes steam, as it exhausts too easily in the stroke, before it has done its work. That is just as bad as the opposite practice of drawing a light train at a fast speed with the engine working at a long cut-off. The point of cut-off should suit the load and speed.



THE FIRST STEEL COAL BREAKER—COXE BROS., DRIFTON, PA.

Then the manner in which the injector is worked has a good deal to do with free steaming. If your steam throttle on the boiler head is wide open, so that more steam can go to the injector than is necessary to have the injector supply the boiler, it will affect the steaming. There is no more use in working the injector wide open and in the corner for a moderate supply of water than there is for working the engine that way for a moderate train. Work the injector as light as you can, and supply the boiler. The same injector may not throw as much water at 200 pounds steam pressure freely supplied, as when this pressure is throttled down to 160 or 175 pounds. Try it and see; that's the way the other fellows find out about these facts.

If the injector is working wide open when you are pulling out of a station, don't complain of the boiler because the hand on the steam gage shows you that the pressure is dropping. You are pulling it down by working the injector and the cylinders against the fire at a time when the fire has a hard time to do business, with the sharp, slow exhausts pulling its life out into the smoke arch. Shut off the water supply for a few train lengths and give the boiler a chance; you can hold the water up easier.

If the injector will not supply the boiler when handled this way, look out for the water passages between the tender and the injector. The strainer may be stopped up, the hole in the goose neck may be too small (most of them are), the hose may have a kink in it, which obstructs the flow of the water, or it may be peeled off inside and choked. A No. 9 injector should have a clear waterway 2½ inches in diameter everywhere.

Some of the defects in the draft appliances are very hard to locate, and do not appear to be the same in all engines in the same class or design and in the same service. For instance, the position of the petticoat or draft pipe in one engine may give good results, and this same position in another is all wrong, and she doesn't steam until it is changed. Why is it? you ask. Frankly, most of us can say we cannot explain this fact clearly. The position of the lower edge of the apron in an extension front has some of the same points.

DOUBLE-HEADER ON JERSEY CENTRAL. LEHIGH VALLEY RAILROAD.
TWO SNAPSHOTS FROM LEHIGH VALLEY STATION AT EASTON, PA.

Like does not always produce like, when draft appliances are considered. The size of the exhaust tip has something to do with the position of the apron or draft pipe. A small nozzle giving a sharp exhaust may make so much draft that an incorrect position of the draft pipe will choke the draft down so it gets the proper action on the fire. That is a case of one kind of poison being used as an antidote for some other.

Mud or scale in the boiler is usually charged with the responsibility for poor steaming, partly because the heat does not come through the scale freely; but it also restricts the free circulation of water to the hot sheets and tubes; no boiler will steam freely while in this condition, for free circulation of water and steam is one of the important factors in free steaming. This emphasizes the necessity of thorough washing out of a boiler to give clean water spaces.

Then the heat has to be evenly distributed all over the firebox and to all the flues alike, or some parts will be hotter than others. You know how it affects an engine's steaming to have her burn the fire in some spots and not in others. While this matter affects the production of heat at the grate surface, yet every part of the heating surface should be doing its best to absorb heat and pass it through into the water dancing up the other side to be turned into steam.

If the engine is not drafted right, so all the flues get an equal share of the heat, some of the flues will not be doing their share of the work. When they are stopped up with cinders, that puts them out of commission altogether. They are no better than hoboes—they don't work; just ride along.

A very sharp exhaust sometimes makes so much back pressure than the engine has to use a lot of live steam to push the exhaust steam out of the small nozzle. This will affect the steaming, because it increases the amount of steam needed to handle the train. The time must be made, you know. "Get there" is the most imperative rule nowadays.

Are not more of the nozzles too big than too small? you ask. Hardly, for a smaller nozzle so as to burn more coal is the universal panacea for poor steamers.

A small nozzle breaks the coal up in the box, so you don't have to break it on the tender deck; it lifts a heavy fire, so you can load her up and then look out for the next coal chute; it lifts it off the grates, so the clinkers will turn up on edge when you are careless about your fire; it makes lots of black smoke, so you are sure that the fire has no holes in it. Do you wonder that the small nozzle is in favor with a man, when it can be used to cover up these mistakes?

We do not wish you to understand that a small nozzle is not needed in some cases; for you must have the proper amount of air pulled up through the grates for the coal to burn freely and make heat, to have a free steamer. Some kinds of coal burn so slowly that the fire must be thick to have enough burning at one time. This takes a smaller tip than with a free-burning, hot coal which does best with a thin fire. That is where the variable-exhaust nozzle inventors get their argument.

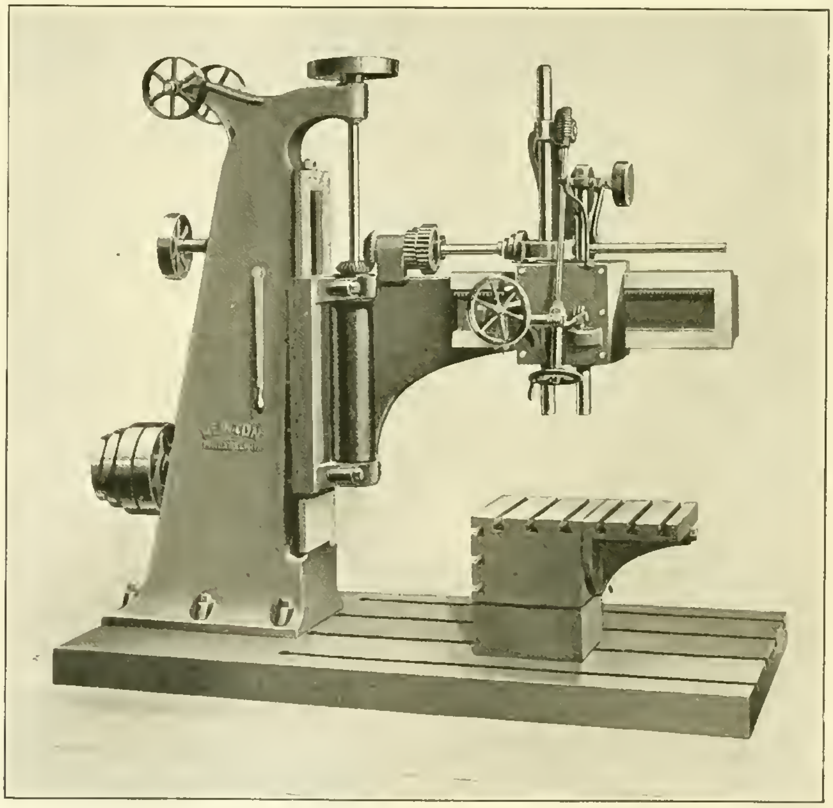
What about the front-end arrangements? Well, we will have to try a crack at that next time. In the meantime, figure out how many pounds of water the boiler evaporates for 1 pound of coal. One gallon of water for 1½ pounds of coal is a fair average. Try and find out by the time this subject comes up again, and that will put you on to some other facts.

New Radial Drilling and Tapping Machine.

While the general construction of this machine is similar to that of the ordinary radial drill, it has features which are believed to make it one of the most economical tools for drilling and tapping in railroad shops. It is belt driven and back geared on driving shaft, the arm being 6 feet long from center of trunnion. The drilling spindle is 2 13-16 inches in diameter and has an automatic feed of 17 inches. A lever on the side of machine enables the arm to be raised and lowered by power.

One of the special features is in the drilling head. The spindle on the left side is driven direct by spiral gearing from driving shaft. From this a train of gearing operates the tapping spindle. When the lever is in the position shown, this tapping spindle is idle, but when lowered it engages the clutches inside and revolves the tapping spindle at one-third the revolutions of the drilling spindle. Lifting the lever reverses the tap and backs it out at the drilling speed, or at three times the tapping speed.

In operating, both the drill and tap are placed in their respective spindles, and the operator brings the drill to the desired point. After drilling, one revolution of the indexed hand wheel brings the tapping spindle to the exact center of the drilling spindle. This makes only one setting necessary to drill and tap, and there is no changing from drill to tap and tap to drill, as is the case with only a single spindle. The machine is heavy and well built, as are all the tools made by the Newton Machine Tool Works, Inc., of Philadelphia.



NEW RADIAL DRILLING AND TAPPING MACHINE.

He Got the Job.

Billy Armstrong is an Irishman well known further down the State by railroad men, and they never tire of telling how Billy hit the Lehigh for a job as telegraph operator. There was a vacancy and Billy applied for it. The trainmaster gave him a rigid examination.

"What would you do," he asked, "if you received an order to hold all trains West?"

"Well, sor, Oi'd put me bhlock at rid, sthick a rid flag into the cinther of the thrack, put a coople of dozen torphaedoes on the ra-hail and whin the ingine came along Oi'd wave me hands achross the thrack wid all me moight, and whin the conduchtor and ingineer axed me phwat

Oi wanted, Oi'd tell theim to whist awhile, and divil a wheel musht they turn until Oi give the wor-rd of command."

After the trainmaster had recovered from his surprise the examination proceeded.

"Now, sir, you are in the train service and are coming West on No. 1, and you get an order to wait at Deer Run until 12:40 P. M. for a wildcat East. Now, what would you do?"

"Well, sur, Oi'd go to see the deer run and sthay there until 12:40 pay em."

"Well, at 12:40 P. M. the wildcat has not shown up; then what would you do?"

"Oi'd wait tin minutes for various clocks and watches."

"That would be until 12:50 P. M.; the wilcat has not shown up. What would you do then?"

"Oi'd wait five minutes mohre."

"That would be until 12:55 P. M. If the wildcat had not yet arrived, what would you do?"

"Then, be jabbers, Oi'd go to the nearest farmhouse and ingage board fur meself and two min and let the eagle-eye on the head end wid his man Friday wid the scoop take care o' themsels, or take a job husking corn for their board until the wildcat did come along."

Determined to see it through to the end, or leave his battle-scarred body on the field, the trainmaster again returned to the charge, grim determination stamped upon his features.

"Now, sir, you're running a special West, and as you round Horseshoe Curve at Punxsatawney, running at the rate of 40 miles an hour, you see a wildcat on the same track running east at the rate of 60 miles an hour. Now, what would you do?"

"What would Oi do, is it? Well, well, sure what divil question is it anyway; what would Oi do? Sure, man, if Oi hadn't a pisthol, slung shot, cannon or mushkat, sure Oi'd climb a tree. What would Oi do, is it, you ax? Do yez think Oi'd sthand sthill and let that divil of a wildcat be makin' his breakfasht of the loikes of me? Divil a bit!"

The trainmaster decided Billy had passed his part of the examination and sent him to the chief dispatcher's office for further inspection.

Billy being rather husky, the operators concluded to "cut out" the usual joshing an applicant gets when up for test. But at the same time they thought they would test him as no one was ever tested, and the chief being absent, the opportunity was excellent.

Looping a wire across the office through the switchboard and putting lots of "juice" on from storage, making the short circuit appear like a hearing wire, all was soon ready. "K. N." Knapp, the fastest man on the road and one of the fastest in the United States, seated himself at one end and Billy was placed at the other end by "B" Bowler, who had been introduced as the "chief." Then he was told to go ahead and see what he could do on the Philadelphia grade.

After Billy had, as he supposed, answered Philadelphia, the "stuff" began to come, and Billy began to sweat, but humping himself on the desk with a grip on his pen like a crocodile's jaw when he takes hold of a pickaninny's leg, Billy began to "copy," and such "Morse" was never before heard in that or any other office.

By this time the whole office force had gathered around him and were peering over his shoulder, but he was too busy to be conscious of anything but the pound, pound of that little sounder in front of him.

After ten minutes of such work Knapp began to tire and Billy had not "opened" on him. As soon as Nat began to slow up Billy opened his key and like a flash of lightning tearing a streak across Old Mother Earth, said:

"Here, you Rube, you keep going there. Do you think this is the first day's session of the primer class in the district school?"

Knapp fainted and the rest of the boys scattered to their respective desks and wires, and when the chief showed up Bowler told him he had tested Billy and he was O. K., and he was sent out on the line to work.

Some More Long Cars.

The Lake Terminal Railroad Company have 102 gondolas, 66 feet 4 inches long over the end sills, which they use to deliver 60-foot rails and other long structural steel. They are of 80,000 pounds capacity; their light weight is 48,000 pounds.

These cars are of course very strongly trussed, having twelve 1¼-inch truss rods, eight of them running the full length of the car, four in the middle of the car, two being on each side. Attached to these short truss rods are another set reaching up along the side of the gondola, to prevent the car buckling up when being pushed or in a collision.

The side sills are of wood, 5 x 14; intermediate sills, 4 feet by 8 inches, Georgia pine; diamond frame truck, with "Common Sense" bolster; 5 x 9-inch journals. Bettendorf body bolsters are used. The brake equipment is Westinghouse, with National hollow beams.

These cars are not very handy to get around in a crowded yard on short curves, as they are so long that they take a good deal more side-clearance space.

When long steel rails are shipped on these long cars, it cuts the car-mileage bill in half. Of course when loaded with any short material, it is placed near the ends of the car, *never in the middle.*

The Joseph Dixon Crucible Company, Jersey City, N. J., have issued a little booklet on "Facings," showing the use of graphite for foundry work and giving suggestions for different kinds of work.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

We do not publish the names of those who ask questions, but we want to know who they are, and will not answer unless the names are given. If H. E. R. will send his name we will answer his question. When it comes to letters or articles we must not only know the name, but publish it as well. No one should want to print a letter he will not back up with his signature.

(85) F. R. S., Bangor, Me., asks:

What mileage can they get from a gallon of oil, in locomotive service? A.—The Southern Pacific Railroad allow 200 gallons of oil as being equal to a ton of coal. As their passenger engines burning oil run about 60 miles to 200 gallons of oil, it gives about three-tenths of a mile to the gallon.

(86) R. S. A., Bellefonte, Pa., wants to know to what extent the flues in a boiler act as stays in preventing the bulging of the flue sheets. A.—Numerous tests made in 1881 by J. M. Allen, president of the Hartford Steam Boiler Inspection & Insurance Company show that tubes which are merely expanded, but neither beaded nor flared, yielded in tube sheet at from 5,000 to 7,500 pounds pull. Those which were expanded and beaded stood a pull of from 19,000 to 20,500 pounds before pulling out. These tests were made on three inch flues.

(87) A. C. L., asks:

What is a good performance for an engine? A.—This is rather indefinite, but we give below the performance record of the Kansas City, Memphis & Birmingham Railroad for the month of July, which will show what is being done, and will probably answer your question: Mileage of forty-one locomotives, 130,298; cost of fuel per mile, 3.88 cents; repairs per mile, 3.95 cents; miles run per ton of coal, 26.39; miles run per pint lubricating oil, 22.19; miles run per pint cylinder oil, 110.8; average mileage of locomotive, 3,178. This includes passenger, freight, switching and work trains on a road operating 282 miles of track.

(88) T. R. S., Fort Worth, Texas, asks how the tonnage a locomotive can haul compares with its tractive power. A.—This depends entirely on the conditions of car bearings, the track and the atmospheric conditions. At 10 miles an hour on level track, and no wind, the resistance is taken at 5 pounds per ton; but of course it takes more than this to start a train. With an engine having a tractive force or drawbar pull of 40,000 pounds, we say it can pull 8,000 tons, *including engine and tender,* on a level track. The allowance for grades varies from 3/8 to 1/2 pound per ton for each foot-rise of the mile. Curves are allowed from 1/2 to 3/4 pound per ton for each degree of curvature. For curves on grades, add both allowances to that for straight track.

Awards.

The Rand Drill Company, New York, were awarded the Grand Prize, as well as gold medals, on their exhibit of rock drills and air-compressing machinery.

The Chicago Pneumatic Tool Company received a gold medal for their exhibit, and Mr. Boyer was given a separate medal—also gold—for his inventions in the pneumatic-tool line.

Gould & Eberhardt, Newark, N. J., received a silver medal for the general excellence of their exhibit at the Paris Exposition. This included their Victoria gear cutter, cutter grinder and extension base shaper.

Messrs. Manning, Maxwell & Moore, sales agents of the Shaw Electric Crane Company, inform us that this crane has received two awards—one a gold medal as a general mechanical apparatus and a silver medal as an electric appliance for hoisting. These are the three-motor electric traveling cranes which are well known in railway shops.

Fiber Strips.

The Lake Terminal Railway Company, which is the switching department of the Lorain Steel Company, are using indurated fiber strips on the crossheads, where brass or cast-iron strips are commonly used. There fiber gibs give much better service than brass, leaving the guides in better condition with less oil, and do not seem to wear the metal away as fast as the other gibs.

The fiber strips are riveted to the crosshead with eight copper rivets. It has been the opinion that small particles of dirt or grit would lodge in the fiber and tend to cut the surface of the guide, but such is not the case. These engines work among the mills, where there is more or less dust and grit flying—a more likely place for trouble than on a main-line engine that is clean because it is ahead of the dust.

Master Mechanic Cargo is also trying some main rod brasses with strips of fiber in the recesses for babbitt, with very good results. With the heavy work when drawing a train of ore or coal up from the docks, it was not unusual to sometimes start the babbitt. Where this has been replaced with fiber, the pins wear smooth and run cool in any service. Four of the ten engines are now using fiber; the others will soon be equipped.

Our friend George H. Daniels, of the New York Central, is sending out a folder called "A Green Hand's Story." It tells of the impressions of an employé and shows how the men of the great railways work together to form a harmonious whole. It is interestingly written, and will be sent on application.

King Coal in the British Isles.

BY HUGH SHARP.

Until quite recently Old King Coal of Great Britain was such a merry old soul that he felt himself able to announce to the British consumer that not only was he master of the situation for the present, but that he proposed to remain master of it for some time to come. But hardly had he boasted himself of the morrow, when a day brought forth two unexpected competitors in the shape of heat briquettes and, of all things in the world, briquettes of Thames mud! As the deposits of peat in both Great Britain and Ireland are pretty well inexhaustible, he is a good deal exercised over these peat briquettes. Heretofore the trouble with peat has been to place it on the market in a form suitable for general purposes; but in this latest form of briquette, the trouble, according to the patentees, has been successfully overcome, and briquettes have arrived to stay. Even locomotives may, at a pinch, steam smokelessly on peat, and, what is more, the waste gases from the smokestack will be extremely beneficial to those suffering from pulmonary complaints, if the doctors may be believed. As to Thames mud manufactured into a briquette alleged to resemble "dull ebony," King Coal regards this as either too good or too bad to be true. Yet great quantities of Thames mud are already being converted into briquettes, and it may be that the claims of the inventors are not exaggerated when they say that their product is of high calorific value, is odorless, leaves "only" 25 per cent. of firm ash and is cheap at $1.80 per ton.

But there is another side to the coal question. The prohibitive prices demanded by the coal ring are liable to have a disastrous and far-reaching effect on the British export coal trade, which will only be realized when the present boom is over. England's best customers, Italy, Norway and Sweden are purchasing heavily of American coal. The outlook, therefore, from a patriotic British standpoint is gloomy, for American enterprise is not likely to relinquish markets once secured; and indeed, a scheme is already on foot, and will be pushed for all it is worth, to wrest finally from Great Britain those European markets which she has come to regard as safe from all outside competition.

But to return to the British consumer, he, at any rate, can look forward to winter with equanimity. He can keep up his temperature and inhale the healthy fumes of peat, or he may elect to sit in comfort around a fire of Thames-mud briquettes, providing he has his ashpans enlarged; and if he chooses the latter form of fuel it should be interesting to him to reflect that applied science has at last proved that the feat of setting the Thames on fire is, despite the old adage, no longer impossible.

Standards.

BY W. DE SANNO.

A few years ago one of the railroad publications illustrated by a row of busts of a woman, all exactly alike, to show what standards were like at the conventions and what like at home. The same row of busts was used, but the features of each were distorted just a little, but enough that no two of them were alike.

Now we will not go to the convention, but stay in the shop. What I am trying to get at is a uniformity in air-pump repairs. It is a common practice in reboring the cylinders to "just true them up." I make the claim that this system is wrong in its entirety. It is unhandy in making repairs, and expensive in practice. Rebore by sixteenths and bore to a gage; have spare parts made to gage, and to fit the new size. Stamp the size on the edge of the flange, either for steam or air cylinder.

If the cylinder is again rebored, erase the old marks and give the last size. Have some system of standards in repair work, and not the cut-and-fit way of doing work. Don't allow the air-brake man to go to the lathe man and tell him to turn a little more off or it is too loose. If the work is made to gage and the gage is right, the work will go together. Have gages for all rings and grooves, and not have the lathe man hunt up a ring and then cut the groove to suit, without knowing whether the ring is standard size or not. It is just as easy to have things right as to have them wrong. In testing air pumps, it is not good practice to pour oil into an old tin lid and then hold it up against the air inlet, allowing the pump to suck the oil through the valves. The pump is then taken down and shipped to a distant point without boxing; the result is, the air holes are full of sand and dirt, the valves ditto.

There is another damnable practice with some air-brake men—it is, to use an alligator wrench to unscrew the boiler attachments(nuts, etc.), or to use a set and hammer to start the brass work. Men who use the alligator wrench on brass work can find their proper sphere out on the "rep." track where they can do no harm.

Automobiles for Collecting Mails.

The Post Office authorities of New York city are conducting a series of experiments with automobiles for collecting mails. The machines used are of the small, electric-motor kind that run right up on the sidewalk to the letter-box. The most successful test made was in a crowded portion of the city during rush hours. The district has twenty-eight boxes, and the record time for collection has been 50 minutes. The time made in the automobile test was less than 22 minutes. Should the machine service prove satisfactory, other cities will probably follow.

A New Trouble.

In the winter time iron ore will freeze solid, so it must be thawed out before it can be unloaded. With the pressed-steel hopper cars the temptation to thaw them out with a wood fire up next the bottom of the hopper on the frame, is too strong to withstand. These fires usually ruin the brake equipment if located there.

Why cannot these cars be pushed into a small house or enclosure just large enough to hold them and turn a stream of hot air in the enclosure, handled by a Sturtevant blower? The hot air would have a good effect on the cold material and thaw it out without doing the equipment any damage.

Ore is usually unloaded near the blast furnaces, where there is an ample supply of hot air. Ore that is thawed out with steam turned into it is always wet, so it soon freezes again. With hot air circulating around the steel car and its load of ore, it would soon thaw out, and at the same time evaporate some of the moisture, so the ore will be in better condition to handle.

Large English Electrical Works.

English capitalists are evidently determined to make a bold attempt to get a share of the electrical trade from the large American concerns, and have recently established the English Electric Manufacturing Company, Limited, with works at Preston, in Lancashire, England. The works cover 12 acres of land, with about 5 acres under roof at present.

The machine shop is a building 900 feet long, 120 feet wide and 35 feet high, in the clear, with a head room of 25 feet under cranes. Cranes varying from 30 to 40-ton capacity are freely used, showing that they appreciate modern methods of handling material.

The foundry is 465 feet long, 620 feet wide and has two 30 and two 15-ton cranes. Conveniences for the workmen, in the shape of hot and cold baths, private lockers, etc., are to be commended.

It is also interesting to note that Prof. S. H. Short, well known in American electrical circles, is the technical director and planned much of the plant.

GATE CONTROLLED FROM HOUSE BY CHAIN RUNNING THROUGH PIPES SHOWN.

INTERNATIONAL CORRESPONDENCE SCHOOL BUILDING, SCRANTON.

SNAPSHOTS ON THE ROAD.

A Flange Saver.

On the switch engines of the Lake Terminal Railroad Company at Lorain, Ohio, the flange wear of driving-wheel tires was excessive, owing to the short curves in the tracks, it was not unusual to have the flanges worn thin enough to require tire-turning in four or five months. To remedy this, a small pipe is tapped into the boiler below the water-line, with a globe valve in easy reach of the engineer, similar to the arrangement for the water brake. This pipe branches and leads to the front and back drivers, where a small stream of water is discharged against the flange just before it comes against the head of the rail. This method takes very little water; it is convenient to operate, and the tire will run as long for the flange wear as for tread wear.

There is one pipe for the right side of engine and one for the left. When working on curves, the valve is cracked on the seat a trifle. A very little water sprayed against the tire does the work, as all the steam which comes out with the water is condensed at once.

This method does not throw any surplus water on the machinery or splashers to work down on the axles or hub liners.

There exists at present in Great Britain a fierce spirit of unrest among the railway employés of a great many railways. A strike has just been settled on a railway in South Wales, and the same form of struggle is threatened in other parts of the British Isles. The railway men are nearly all members of labor unions, and when a dispute arises they naturally wish to have the union leaders treat with the companies. It seems to be the settled policy of British managers to refuse to treat with persons who are not in the employ of the company, and they try to obtain public sympathy by declaring that they are ready and willing to listen to the grievances of their men when presented by the men themselves. This seems fair enough, but from bitter experience the men have learned that it is dangerous to accept the position of a representative of their fellows and become exponents of the grievances complained of. Men who have acted that part in the past often found themselves looking for employment elsewhere.

Our new Book of Books should be ready by the time this reaches you. Better get one.

Instruction About New Devices.

Superintendents of motive power should remember that when new devices are introduced, the men who are to use them should have an opportunity to study their construction and have the operations explained. In this way the advantages of the new device can be shown and possible defects and break-downs anticipated.

Much of the prejudice against the compound engine arises from the fact that the advantage most frequently spoken of is hauling a heavier train, and the complications incident to the changing from simple to compound are not fully understood. The care and handling of a disabled compound is somewhat different from that of a simple engine. When first put on a road this causes trouble.

Explain all these matters.

The Bethlehem Steel Company are sending out a very handy card containing the United States Navy standard test specimen on one side and on the other a table giving the properties of steel forgings made by them. For instance, we find under the first class of oil-tempered nickel steel, that they will guarantee a solid forging of not over 3 inches in diameter or a hollow forging not exceeding 3 inches in thickness at any point, to have a tensile strength of 95,000 pounds per square inch of section. The elastic limit will be 65,000 pounds and the elongation 21 per cent., while the area will contract 50 per cent. at point of breakage before it parts. Similar specifications are given for carbon steel, both oil-tempered and annealed, and it shows at a glance what we may expect from high-grade forgings in the different metals and from different sizes.

Life of the Modern Steel Car.

Various conjectures and surmises as to the length of life of the modern steel car have prompted the Pennsylvania Railroad to make investigations along a line that will result in securing definite and reliable data. In this investigation there were found steel cars which had stood loaded with coal on a side track for seven months, in all kinds of weather, and the only deterioration resulting was a very thin coat of rust, which was readily removed and was obliterated by a coat of paint. Reckoning from this experience as a basis, it is reasonable to assume that the life of a steel car should be twenty years or more.

The John Davis Company, Chicago, Ill., favors us with a new catalogue and price list, which those handling piping, piper's tools and similar work will want for reference. In addition to about 270 pages of valves, tools and fitting, there are a number of tables in the back of the book which are valuable to any mechanic who wants to add to his stock of knowledge. The Climax universal joint and their other specialties are also shown.

New Railway in West Poland.

The Warsaw-Vienna Railway Company has been authorized to built a line from Warsaw, *via* Lodz, to Calish and Skalmerjitze, as well as a connecting line between the new one and the Vistula railway lines in Warsaw. The railway is to be constructed within three years and will be about 165 miles long. It will run through the Warsaw, Petrokov and Calish governments, which contain 4,144 square miles, with a population exceeding 60,000. Joining the Prussian lines near Stchiporn and crossing densely populated localities, the new line will connect the towns of Blone, Sohatchev, Lovitch, Lodz, Lask and Sieradz, and such prominent manufacturing centers as Zgierz, Pabianitze, Zdunska Vola, Blashki and Opatovsk.

The new class E 2 engine of the Pennsylvania Railroad, No. 269, has been giving a good account of itself on the West Jersey road. It recently hauled a train of fourteen loaded coaches from Camden to Atlantic City in 52 minutes, making an average speed of 68 miles an hour. While the run has been made in a little less time with a light train, this is a remarkable run for a train of this weight. The engine is a modification of the E 1 class, which was illustrated in our issue of August, 1899.

Locomotives of Rigorous Specifications

A news item has it that the Manchester Locomotive Works have contracted to build for the Intercolonial Railway of Canada eight of the largest and fastest locomotives that can be constructed. An odd specification, and we shall watch with interest its fulfillment! It is said that this is the first Canadian order the works have had in twenty-eight years, the last being for the Grand Trunk system.

Success says there seems to be a general impression that the college graduate is losing caste; that he is becoming a very ordinary being. This is due, not to the fact that the college man is deteriorating, but that the masses are becoming better educated through the rapid increase of newspapers and periodicals, the establishment of free libraries, university extension, evening schools of all descriptions in the large centers, correspondence schools, Chautauqua reading circles, and summer schools.

The first order for steel cars for use in Spain has just reached the Pressed Steel Car Company, of Pittsburgh. They conform in their make-up to the American standard ore car of 80,000 pounds carrying capacity. The seventy cars will be made for the Great Southern of Spain Railroad. In Spain they term these cars "bogie iron ore wagons," and a peculiarity in the construction is that a timber shelter for use of brakemen is specified on seven cars out of the seventy, presumably one to each train.

Fastest Mile Ever Covered by a Warship.

The fastest time ever recorded by a warship was recently made by the British torpedo-boat destroyer "Viper" in a trial trip, when she covered a measured mile at the rate of 41 miles, or 36 knots, per hour. On a three hours' run she averaged, without forcing, close to 34 knots per hour, thereby exceeding her contract requirements by 5 knots. This phenomenal speed was made possible by the employment of the Parsons turbine engines, which first came into prominence a few years ago on the "Turbinia."

The Cloud Steel Truck Company have issued a pamphlet as a reminder of their exhibit at the Saratoga convention. This shows the construction of their Bettendorf I-beam body and truck bolsters, which are made from standard sections of open-hearth steel. The construction of these bolsters is both novel and substantial.

Wreck Reduces Prices.

A recent wreck at Kensico, on the New York & Harlem Railroad, which spilled 150 tons of ice and 2,000 bushels of oats, lowered the value of those products very much below that quoted in the market reports. A carload of oats worth $300 sold for $12.50, while the ice was to be had for the carting away.

The Crescent Steel Company are quite elated over receiving the Grand Prize at the Paris Exposition. They very pertinently say: "If you still think that steel to be very good must be made abroad, we hope the above award, made by an international jury, in competition with the best steels of other countries, will prompt your early trial of our products."

The Robert Aitchison Perforated Metal Company have issued a neat little booklet of a few of the varieties of perforated metals they turn out. They make over 600 varieties of perforations, so that an idea of their facilities can be obtained. The latter part of the book contains a number of useful tables for those having to do with sheet metals.

American Coal Abroad.

The higher price of English coal has made possible the exportation of American coal to European countries, and many large firms are already placing orders in the United States. The Anthracite Coal Operators' Association has an agent now touring England, France, Belgium and Italy to ascertain the possibility of coal export to those countries. It is reported that the Baltimore & Ohio Railroad also has an eye on the trade, and has sent an agent to Italy to secure Mediterranean dock privileges.

New Cotton Crop's First Bale.

Each year there is a sharp rivalry among railroads to handle the first bale of cotton of the new crop. Odd and numerous tales are told of the maneuvers of freight agents to capture the transportation of the snowy bundle. This year the first bale comes from Memphis, and the Delaware, Lackawanna & Western is the first New York road to carry off the honor of handling the prize.

Keep up to date in air brakes and know what is being done in the air-brake line on all the principal railroads, by reading the experience of the leading representative air-brake men from Maine to California and from Canada to Mexico. See Jacksonville Proceedings, 1900. Paper cover, 50 cents; leather, 75 cents.

Mr. H. S. Herrick, of Kern, Cal., sends us a monthly performance sheet for that division of the Southern Pacific. He uses a comptometer to aid in his work and finds it a great labor-saver as well as mistake-preventer. Each tub of coal weighs 1,100 pounds, and instead of multiplying the number of tubs by their weight and dividing by 2,000, he gets tons direct by multiplying the number of tubs by .55. In a similar way he saves time in figuring "miles to pint of oil" and other data.

A Good Record.

The Big Four's "White City Special," running between Chicago and Cincinnati, was put on three years ago and holds a remarkable record. During this time it has never had an accident and has never been late, but five times, except when detained by high water.

Read what the leading air-brake experts of the far Western mountain roads, the hilly roads of the East and the rolling roads of the Middle East and South have to say about air brakes in up-to-date road service. See the Jacksonville Proceedings. Paper cover, 50 cents; leather, 75 cents.

Train Suction.

A little ten-year-old girl, who was standing on a station platform, too close to a swiftly passing Long Island Railroad train, was sucked in against the cars, struck by the rear steps and fatally injured. Not far from this point, and on the same road, bicyclist Murphy one year ago demonstrated the power of train suction by riding a mile in a minute in the vacuum of a train. Here are two striking object lessons on train suction.

Northern Pacific Cancels Freight Car Order.

The Northern Pacific has cancelled orders recently given for a large number of new freight cars, the partial failure of the wheat crop in the territory of the road being assigned as the reason of the action.

Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

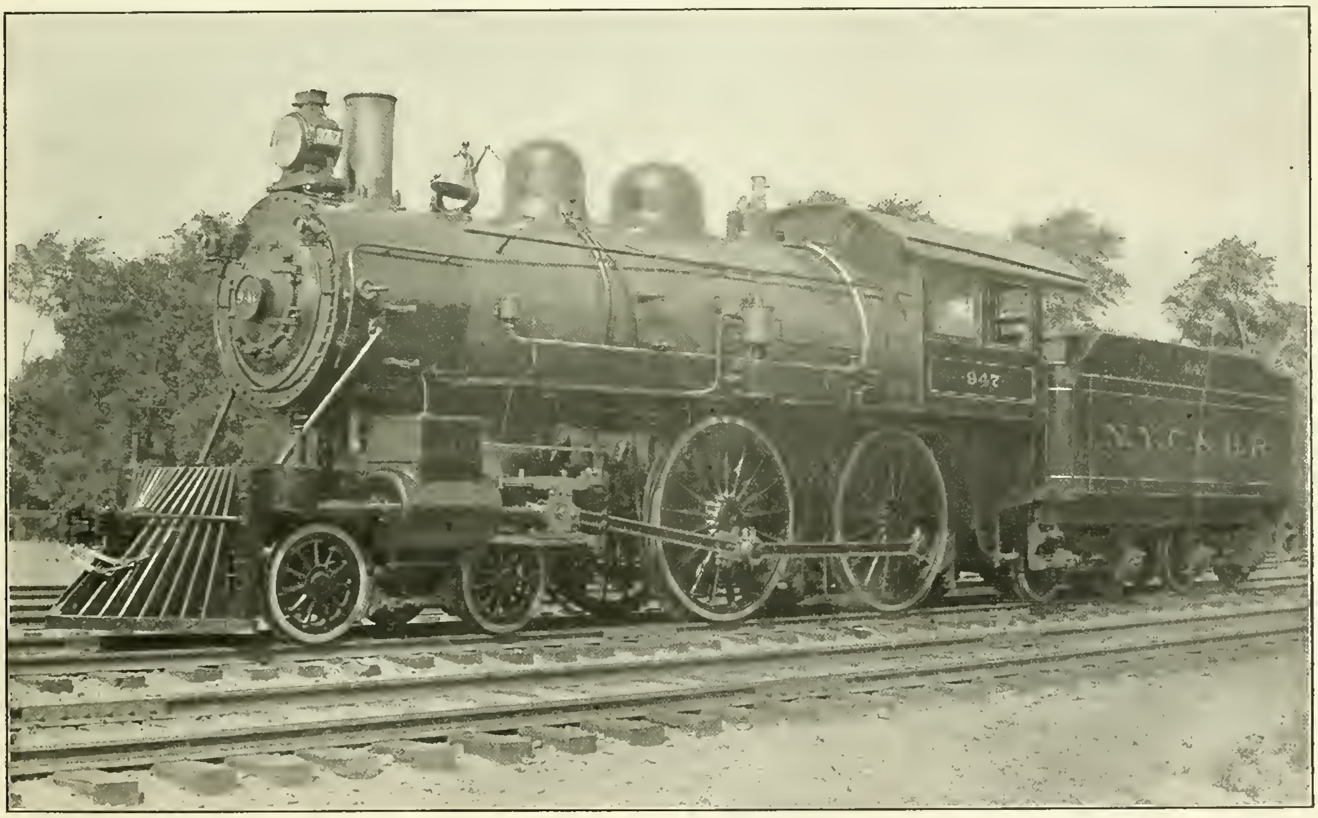
Vol. XIII 95 Liberty Street, New York, November, 1900 No. 11

New York Central's Latest Express Engine.

The handsome eight-wheel locomotive hereby illustrated is the latest express engine designed by Mr. A. M. Waitt, superintendent of motive power, for pulling the fast express trains over the New York Central Railroad. This engine was built in the company's shops at Depew, and was to some extent experimental as it was expected that the tests of service might suggest the making of changes. A large order for engines of this class has now been placed with Schenectady Locomotive works and very few changes were considered necessary. These engines will be known as Class I-3.

The principal aim of the designer was to make an engine that could be depended upon to steam freely under all adverse conditions of weather and load. Like most of the other express engines belonging to this company, the cylinders are 19 x 24 inches and the driving wheels 77 inches diameter, but the steam generating capacity has been materially increased, the heating surface being 2,404 square feet, of which 180 square feet are in the firebox. The grate area is 30.7 square feet. The working steam pressure is 200 pounds per square inch. There are 94,400 pounds resting upon the driving wheels and 52,000 pounds upon the truck. The tractive power is 12,000 and the ratio of traction to adhesion nearly 8, a most unusual figure, but it indicates that there will not be much difficulty with that engine slipping.

The boiler is 65 inches diameter at the smallest ring and has 364 two-inch tubes. The rigid wheel base is 102 inches; total wheel base of engine, 23 feet 8 inches. The tender is carried by pressed-steel trucks, and is equipped with apparatus for lifting the water when train is in motion.



WAITT'S NEW EXPRESS ENGINE.

Makers of Small Tools Take Notice.

A. M. Thackera, the American consul at Havre says: "The market in France for the sale of steel rules, caliper gages and graduated scales is an open one—that is to say, it is not controlled or regulated by any particular house or syndicate. There is, in my opinion, a good opportunity for the introduction into France of this class of American-made tools; and the Americans, with their extensive and practical knowledge and the improved methods they use in manufacturing their goods, should be able to command the lion's share of the trade. Of course, the scales must in every case be metrical, as no other system of measurement is used in France. In this respect, at least, the French lead the way; and it is to be hoped that America will not be long in following suit, as no one can dispute the fact that the metric system excels all others in simplicity and practical usefulness. Its general adoption by all countries is to be greatly desired by those who wish to foster and extend the commercial and industrial intercourse between the various nations."

The Joseph Dixon Crucible Company, Jersey City, have issued a folder of their Silica-Graphite paints, which is a very convincing statement as to its durability in railroad bridge work.

The Fastest Trains of the World.

There is a certain class of newspaper writers who are always protesting because railway trains and ocean liners are not run at the highest velocity that has been found possible. There is considerable of this spirit displayed in the American newspapers, but Great Britain is where it flourishes like a green bay tree and always is in evidence. When an Englishman thinks himself suffering under some real or fancied grievance, his natural impulse is to ventilate it by writing to the *Times*. If the subject is deemed of general importance, other papers copy the communication, and a heated controversy ensues; for there are always two sides to every question.

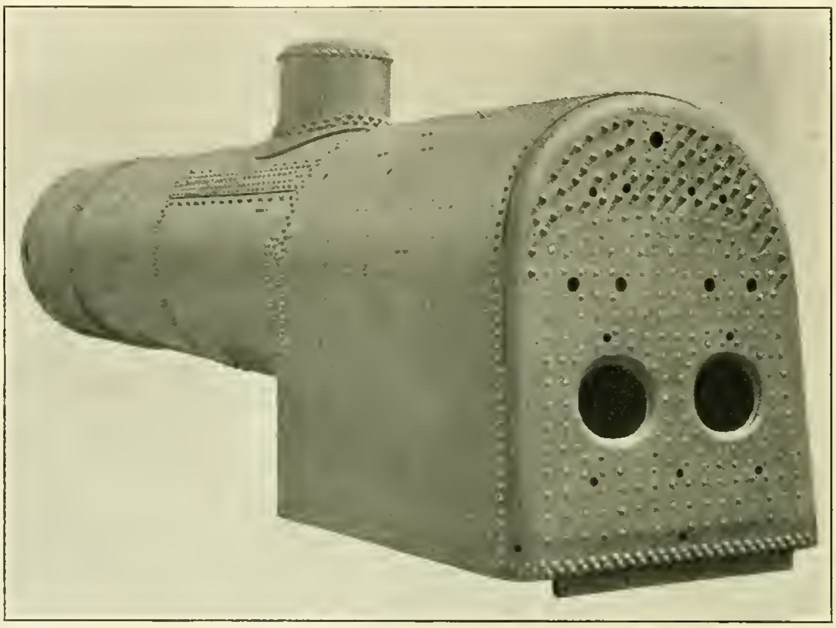
The successful running of the Atlantic City express trains on the Pennsylvania and the Philadelphia & Reading lines this summer caused a heated controversy in the British press regarding train speeds in the British Isles. The usual fault-finder wrote to the *Times* lamenting that there were no trains in Great Britain that could compare in speed with trains run in America and that even the despised France was beating England in the speed of its trains. A great many loose statements were then made in rebuttal of the charge that England was falling behind in the running of fast trains, and about as many in support of the critics. Then the engineering papers took up the question and demanded exact facts. Among what may be regarded as accurate tabulated statements published we select that given by the *Engineer*, as it was, we believe, prepared by one of the best authorities in the world on train speeds. The figures will be interesting to Americans as well as to others concerned—and who is not interested in train speed?

The data given in the tables embraced only trains run in daily service for at least 100 miles distance. That, of course, excluded the Atlantic City expresses. Britain runs more express trains than any other country, and particulars of thirty-eight trains are given which make an average speed of 49.9 miles per hour. For the United States fourteen of the fastest trains were dealt with, the average speed being 42.8 miles per hour. For France, the speed of eleven of the fastest trains was given, and they make an average of 48 miles per hour.

From these figures it will be seen that the United States have no right to boast about the high velocity of trains. There is only one train in the country that exceeds 50 miles an hour in speed for 100 miles run, and that is the Empire State Express. Only one other train makes an average speed of 49 miles an hour. Great Britain has twenty-two trains that make an average speed over 50 miles an hour. Of the eleven French trains mentioned, four make a speed exceeding 50 miles an hour. Britain has three trains that exceed the Empire State Express in speed, viz.: Kings Cross to Grantham, on the Great Northern, 105¼ miles, made at an average speed of 54 miles per hour; Paddington to Bath, 106¾ miles, at 54.2 miles an hour; and Penrith to Crewe, 123¼ miles, at 53.9 miles an hour.

The fastest train in the world for a distance exceeding 100 miles is run on the Northern Railway of France from Paris to Arras, 119¼ miles, at 55 miles an hour.

Although the United States railways make an inferior showing on express trains, compared with the other two countries, we are certain that the engineering performance is on the American side. In Britain and France an express train rarely has to check speed from the moment it starts until it reaches the terminus. Besides this, the trains are nearly always light, as compared with those hauled on American railways, a train with more than 200 tons behind the tender being very rare. When such a train is seen, there are nearly always two engines pulling it.



BOILER FOR NEW YORK CENTRAL'S NEW ENGINE.

Railroading in Maui, Hawaiian Islands

We quote from a private letter of a friend who has gone to one of our new possessions to show them how to railroad in the good American plan. He says:

"Perhaps you would like to hear something about a part of our new possessions, the island of Maui, H. I. This island is 60 miles long, with a varied width of from 10 to 40 miles. The soil on the mountain slopes is very productive, and about all kinds of fruits and vegetables grow and produce large crops and of a very fine quality, including excellent potatoes and corn. On the low lands sugar cane is the principal product, and is brought about by irrigation. You can ride for 15 or 20 miles through fields of handsome cane, 12 to 20 feet high, having stocks as large as a large man's wrist.

"The climate is something wonderful, for although so near the equator, the thermometer rarely rises above 87 degrees, the trade winds tempering the heat so that for man or beast the days are very comfortable. The nights are fine, a gentle breeze blowing all night, which is so cool that one cannot help sleeping, and that soundly, too, if his or her conscience is anywhere near clear. In the morning you wake up to find the mercury down to 68 degrees; you are rested and refreshed, ready for your day's duties.

"Fruit, such as bananas, figs and many others, grows here in almost every yard, and flowers abound. All you have to do is to set them in the ground and give them plenty of water, and the results are wonderful. They blossom continuously the year round. I have two oleander trees, one each side of my gate, fully 25 feet high, and there are, and have been each day for the last three months, fully one thousand blossoms on each one, and as many buds ready to take their places when they are gone."

Kinder makes a fellow want to go there; doesn't it?

One of the most useful patented inventions that we have examined lately is a "shaft detacher" designed by Miss Fanny C. Grothjean, a young artist residing in New York city. Miss Grothjean happened to be in a runaway, and while going through that experience realized the benefit it would be to have the means of detaching the horses from the carriage. She proceeded afterwards to design a simple means for detaching the carriage shafts by merely turning a handle, and the invention is now upon the market taking well. When the shafts are detached the rod that does the detaching is transformed into a steering gear.

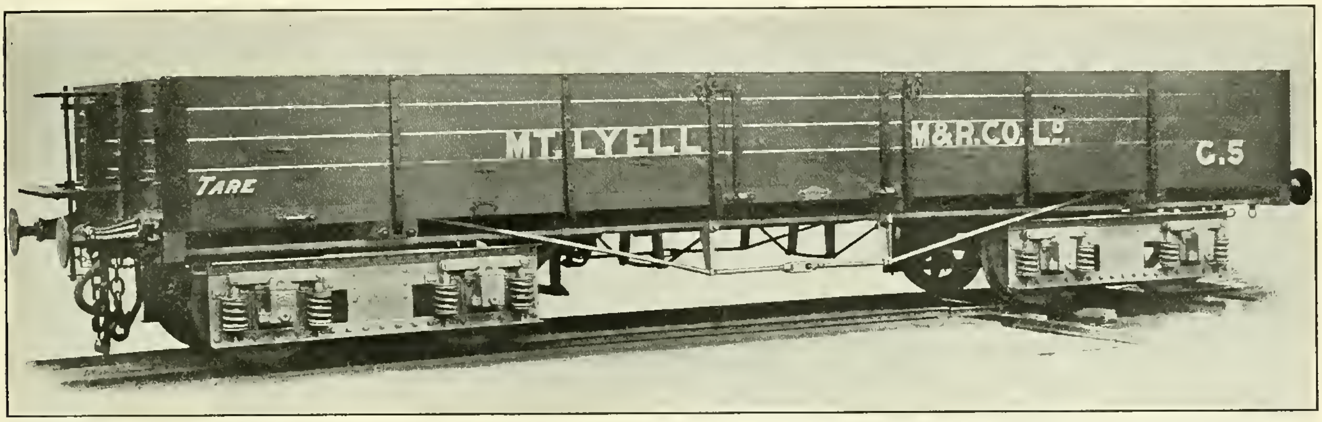
Water That is Too Pure for Feeding Boilers.

We are accustomed to hear and read so much about the iniquities that hard water—that is, water impregnated with lime and magnesia—inflict upon the heating surfaces of steam boilers, that it is a decided novelty to learn about the dangers that boilers are subjected to from the use of nearly absolutely pure water. There are few manufacturing cities on the globe where boiler owners have reason to complain about the water being too pure for boiler purposes; but there is one such town, and it is Glasgow, in Scotland. That city receives its supply of water from Loch Katrin, in the Highlands, the loch made famous by Scott's "Lady of the Lake," a most romantic sheet of water nestling in the lap of granite mountains that send down the water that falls from the clouds almost as pure as it was when it touched the rocks. No water in nature is absolutely pure, for that falling from the clouds absorbs carbonic dioxide. In districts near cities, the rain water in falling will take with it sulphur and other gases floating in the air; while near the sea saline emanations will be carried away. Running streams also absorb some peaty and other vegetable matter; but the streams that feed Loch Katrin are remarkably free from the trace of vegetable impurities, and the water in the loch, which is of a bluish-green color, is about as pure as distilled water.

Before the people of Glasgow obtained the benefits of a pure water supply, they got their water from a variety of sources, the drainage of coal pits providing no small part of it. As might be supposed, this water was decidedly hard and caused a great deal of trouble in coating steam boilers with scale. When the supply from Loch Katrin was about to be turned on, some of the boiler owners had their boilers thoroughly cleaned and the scale chipped off; others did not touch the scale. It was soon discovered that the latter, who were not likely to be the most enterprising men, were fortunate, for the pure water did not affect their boilers, but it attacked the sheets of the clean boilers, and in many cases produced serious corrosion before its effects were discovered. During a recent visit to Glasgow, we discovered that it is a common practice for boiler owners to feed lime-charged water into new boilers until a slight coating is formed over the heating surfaces, and after that is done there is no more trouble.

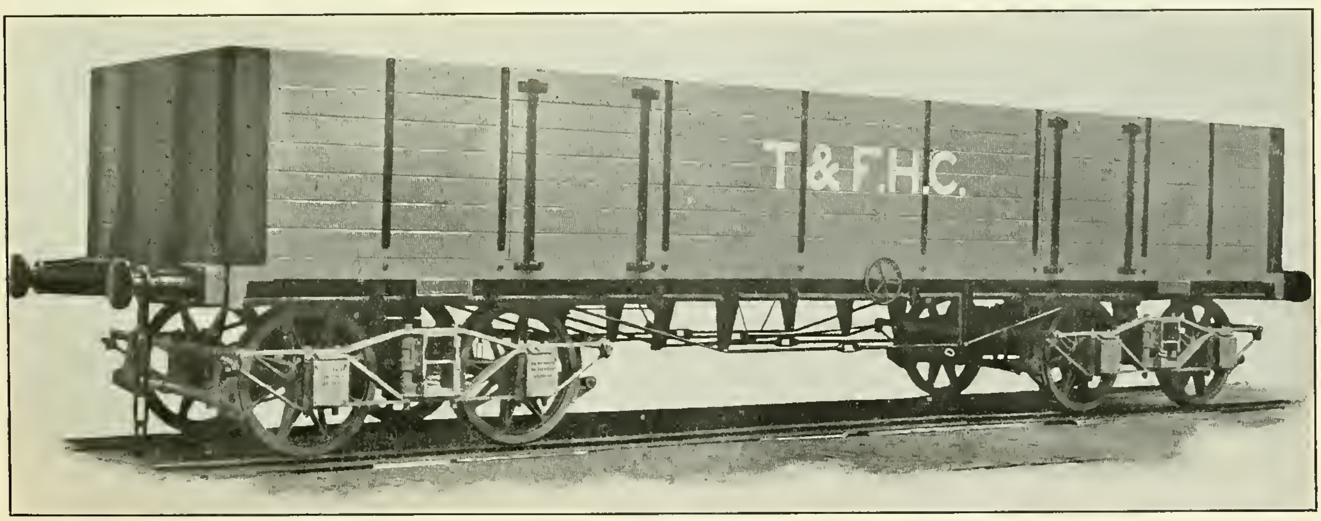
There are districts on the American continent where the water used for boilers is just as pure as that provided in the city of Glasgow. It is likely enough that trouble is experienced in these districts from the corrosion of boiler sheets, which generally takes the form of pitting and grooving. The information about how the boiler owners of Glasgow prevent corrosion may be useful to some of our readers.

Marine engineers have gone through some edifying experience with boiler feed water which is too pure. In the times when jet condensers were employed there was great difficulty in keeping the boilers in efficient working order, as they had to be fed from sea water, which contains a great deal of other mineral impurities besides salt. With the surface condenser now almost universally used, the steam is



20-TON "HIGH SIDE OPEN GOODS WAGON," FOR MOUNT LYELL MINING & RAILWAY COMPANY.

Gage, 3 feet 6 inches; body, 28 feet long. Built by the Lancaster Railway Carriage & Wagon Company, Ltd., Lancaster, England.



30-TON "HIGH SIDE OPEN GOODS WAGON," FOR TRALEE & FENIT HARBOUR COMMISSION, IRELAND.

Gage, 5 feet 3 inches; body, 34 feet long. Built by the Lancaster Railway Carriage & Wagon Company, Limited, Lancaster, England. G. W. Ettenger, agent.

condensed and the water returned to the boilers. When all joints are tight and no escape of steam from safety valves occurs, the cycle of evaporating the steam in the boilers, using it in the cylinders, passing it through the condenser, then pumping it back into the boiler goes on continuously, and the water is almost pure. When the surface condenser first came into use, the engineers expected that their troubles with the boilers were over. Very soon they found that scale had gone, but that the more dangerous trouble of corroded plates had come with the soft feed water. After a time they discovered that feeding from the sea until a slight scale was former, proved an entire remedy.

A DECIDED MIX-UP.

The Traveling Fireman Strikes a Snag.

BY R. E. MARKS.

The traveling fireman on our road has been watching for black smoke lately, and there's an improvement in many places on the road where some of the fellows used to see how much smoke they could make. But he ran up against a snag the other day when he fined old "Pop" Smith $2 for "making more smoke than necessary."

He had been warning him for a week, and both "Pop" and the fireman had been watching things pretty close; but still the old "65" smoked. "Pop" reported "something wrong in the front end," but the roundhouse man swore it was O. K.; and it was up to "Pop" and the fireman to stop the smoke. But he couldn't, and so the fine came along as a pleasant reminder.

Then "Pop" went to the T. F. and registered a kick, and allowed that if he (the T. F.) could fire the "65" and not make smoke, he would make the fine $5 and not say a word.

Now, the T. F. is an expert fireman, and knows his b siness all right, but he couldn't cure the "65" of its bad habit of smoking while on duty any better than "Pop" Smith. So he reported the engine to the roundhouse foreman, and stayed there till her front end was opened, so he could see for himself.

It didn't take long to discover that the exhaust pipe was loose—only held by one bolt, in fact—and that the exhaust was squeezing out almost anywhere except through the nozzle. Not quite so bad as that; but enough went out of the joint, all around the pipe, to raise Cain with the smoke question, and the front end became a smokebox in every sense of the word.

This discovery let "Pop" Smith out of the scrape and made things warm for the roundhouse man, who either had to admit he lied when he said he had opened the front end, or that he couldn't find a loose exhaust pipe, when three bolts were out.

But the moral of this little happening is that not even the best fireman alive can do good work unless the engine is in good shape. Issuing orders against smoke or fining the smokers can't help matters, unless the engines are put in good shape and kept in that condition. And this is the point that some roads have overlooked, and Locomotive Engineering has been blamed because they did so.

"Hoppy" Brennon Dead.

"Hoppy" Brennon was run over and killed by a switch engine in the Jersey City yards a few days ago. "Hoppy" was about twenty-five years old and was well known by railroad men across the river. His baptismal name was William. When he was nine years old he lost his right leg stealing a ride on a switching engine, and was obliged to take to a crutch. He soon became known as "Hoppy." The police said he could get around almost as quickly as a man with two good legs. Once Policeman Doyle was chasing him and had pursued him as far as the coach washing tracks. There "Hoppy's" way seemed barred by a rapidly moving freight train, but "Hoppy," to Doyle's surprise, swung on to one of the cars, climbed to the top like a monkey, and, after thumbing his nose in derision at the "cop," went down on the other side and avoided arrest for the time.

The Four-Track Series of modern publications circulated by the passenger department of the New York Central Railroad are reported to be a pretty good library in themselves. Copies of the series may be obtained by sending a postage stamp to Geo. H. Daniels, general passenger agent, New York Central Railroad, New York.

Symons' Express Ten Wheeler.

We here show a photographic half-tone of a very powerful type of ten-wheel passenger engine recently built by the International Power Company for the Plant System, from designs prepared by Mr. W. E. Symons, superintendent of motive power.

The engine has cylinders 19 x 28 inches, the driving wheels being 73 inches outside diameter. The driving wheel-base is 14 feet and the total wheel-base 24 feet 8 inches. The engine weighs 142,000 pounds in working order, of which 106,000 pounds are on the drivers. The boiler, as will be seen, is of the extended wagon-top type, the firebox being secured by radial stays. The diameter at the smallest ring is 62 inches. There are 300 tubes in the boiler, 2 inches outside diameter and 14 feet long. The working pressure is 200 pounds per square inch. The engine has 23,539 tractive power, and the ratio of tractive power to adhesion is 4.5. In writing about the necessity for having such heavy passenger engines as this one. Mr. Symons says:

"The passenger engines weigh about 146,000 pounds—that is, about 106,000 on drivers and 39,000 or 40,000 on trucks. We have five of the passenger engines now in service, although two of them have just been broken in and are still handling freight. They are doing splendidly, and I have no doubt they will give us first-class service.

"These passenger engines may seem a little large for level ground; our own trains, however, are quite heavy, as we have a great many private and extra cars to handle. The Florida Vestibule usually consists of from seven to eight solid Pullman cars, weighing very close to 400 tons. It is scheduled at upwards of 43 miles an hour, on a single track, handling a heavy volume of freight and passenger business, where a great many stops are necessary, and the train is very frequently late. Speed is governed very largely by the ability of engines to run. Mile-posts here are regularly made in 55 and 50, and often in 48 and 46 seconds.

"Last year, in addition to our own business, we had Southern trains to handle, and when contemplating the purchase of new power, the management were also considering the advisability of consolidating our trains and theirs, the arriving and leaving times of the two trains being very nearly the same. This has already been done with our train 32 and Southern 34, which leave Jacksonville in the morning for New York. The first day these trains were consolidated, it was handled by one of the new engines, the '108.' Mile-posts were usually made, with ten cars, in 58 and 56 seconds, although it was the third trip engine had made."

We expect to make some experiments with these engines soon.

SYMONS' TEN-WHEEL ENGINE—PLANT SYSTEM. LINE CUT ON PAGE 482.

Another Old Timer.

The following is a copy of an advertisement that appeared in the Boston *Columbian Centinel,* August 9, 1834:

BOSTON and PROVIDENCE RAILROAD.

From and after the 28th inst., the Passenger Cars with the Locomotive Engine WHISTLER, will, until further notice, be despatched daily (Sundays excepted) from the Depot at foot of the Common to the Sprague Mansion House, Dedham Low Plain, at the following hours, viz.:

Leave Boston at 6 1-2 a. m. and 4 p. m. Returning, leave the Sprague House at 7 1-2 a. m. and 5 1-2 p. m. Stopping at the Tremont Hotel Roxbury and at the Toll Gate near Colburn's Corner, to land and receive passengers. Tickets 25 cents, to be had at the Depot, or of the Master of Cars. There will be a stage at the Sprague House to carry passengers to and from Dedham Village.

Mexico's First Big Strike.

The first general strike that ever occurred in Mexico was begun by the shop workmen of the Mexican Central Railroad at San Luis Potosi about September 1st. The shops are all closed, and several hundred men are affected. Unless the strikers' demands for an increase of wages are granted, a general spread to the trainmen may be feared.

Reverse Lever for Compound Locomotives.

Those who have watched compounding closely have seen the desirability of at times varying the cut-off in the high without disturbing the low-pressure cylinder. This has been attempted in several instances and by different means, but the device shown with this comes the nearest to accomplishing the desired result of anything we have seen.

To be successful, a device of this kind must not have too many things for the engineer to look after. While it would be easy to put in two reverse levers, one for each cylinder, and to adjust each as occasion demanded, it would be somewhat inconvenient for an engineer to grab a lever in each hand and apply the air with his foot when he wanted to stop.

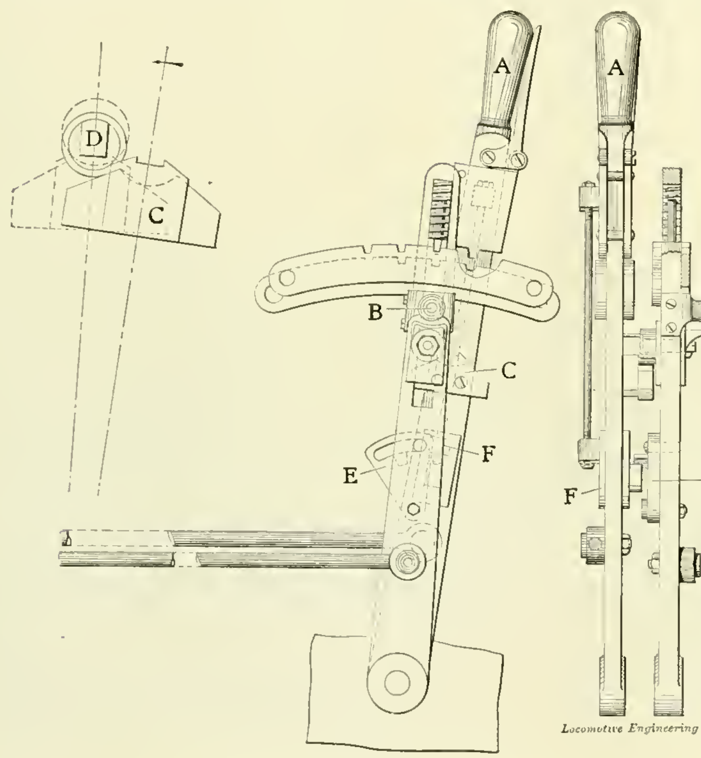
Realizing that an engineer has but two hands and usually has use for both of them, Mr. Clifton Reeves, the inventor, has designed this so there is no more for the engineer to look after than with the plain, everyday reverse lever. In starting, hooking up or reversing he handles the main lever just the same and pays no attention to the other.

Starting out from a station, he throws the main lever *A* forward as usual. Then he hooks the lever up as far as his experience tells him is desirable for the low-pressure cut-off. As he picks up the train and wants to hook up still more, he handles the high-pressure lever *B* until the high-pressure cut-off is right for the work in hand. This always moves the auxiliary (or high-pressure) lever *toward the center,* whether the engine is running backwards or forwards.

When he wishes to stop or reverse, if necessary, the engineer simply grasps his main lever A and pulls it back to the center or beyond, as the case may be, and the auxiliary lever follows it without any attention whatever. The inclined block *C,* on the main lever lifts the latch of the high-pressure lever and locks it into the notch at the top of the incline, making it virtually a part of the main lever.

To prevent any possibility of the upper latch missing fire and allowing the low-pressure cylinder to be reversed without the high, there is another stop lower down on the lever, as shown. It seems to be a very handy way of accomplishing the object and does not add complications for the engineer to look after.

Further details can be obtained by addressing Mr. Reeves, president Reeves Machine Company, Trenton, N. J.



REEVES REVERSE ATTACHMENT.

How Queen Victoria Travels.

The British people are very proud of their Queen and warmly attached to her, personally. All the daily papers publish bulletins of the daily doings of the Queen and her court, and nothing is more popularly read. Another thing that excites great popular interest is the royal journeys from London to Balmoral and return.

The journeys between London and Balmoral are always made in a train belonging to the London & Northwestern, and the route is over that line, the Caledonian and the Deeside railways. The train is a model of luxury, and consists of thirteen carriages, and is nearly 500 feet in length. The train never travels at a greater speed than 35 miles an hour, and during the night this is considerably slowed down. It has lately become the rule for the train to entirely stop for half an hour at about 8 o'clock in the morning to enable Her Majesty to dress comfortably. She occupies two saloons, which are connected by a passage, and only Princess Beatrice travels with her. These saloons are most carefully constructed, and run as smoothly as any C-spring carriage. The day saloon is fitted up as a library dining-room, with tables, armchairs, a sofa, large footstools, and racks for books, parcels and despatch-boxes. The furniture is of white silk embroidered with gold, and the carpet is of velvet. The walls are of polished satin-wood and panelled with mirrors. The saloon is ventilated from the roof, and lighted with shaded lamps, and warmed by gas stoves and hot-water pipes, but these are rarely used, as the Queen thinks they produce a stuffy feeling. Her Majesty sits in a large, low, easy armchair, facing the engine. By her side is a writing table, which is covered with books, paper and writing materials. As a rule the Queen receives and despatches a number of telegrams at Perth. The night saloon is arranged in compartments, the principal one being a bedroom, with two beds—one for the Queen, the other for Princess Beatrice. Next is a dressing-room with a metal bath. There is a compartment for the luggage required on the journey and for two maids or "dressers." Both saloons are fitted with electric light, and the Queen can cause the train to be stopped in two or three minutes. The other saloons are occupied by any members of the Royal family who may happen to be traveling with the Queen, members of the Household-in-waiting, the Royal nurseries, the Indian attendants, and those servants whose special duties involve their attendance occupy the remaining parts of the train. A plan gives the number of the carriages and the names of their occupants, as well as a complete time-table containing every possible information. The Queen's copy is printed on satin in purple, and bears the Royal Arms in gold upon the top. Before and after the Queen's train has passed, all traffic on the various lines is stopped for a certain time. A pilot-engine runs in front of the train as an additional precaution. It is a rule that no signalman is to allow the Queen's train to pass his box until he has received an intimation that the line is clear from the next box in front.

Old Landmarks Gone.

The "Pavonia" and "Cephalonia," two Cunard line steamships, which have plied many years between Boston and Liverpool, have been sold. The former was sold to an Italian shipping firm for $77,000, so it is reported, and the latter to a Russian firm. So rapid has been the development of steamship construction and so great the transatlantic competition, that these steamships are now mere toy-boats in comparison with the present huge ocean greyhounds with five-day records.

General Correspondence.

All letters in this department must have name of author attached.

Curiosities of Journal Wear.

A recital of a few incidents that have passed under the writer's observation may be of interest to the many readers of the LOCOMOTIVE ENGINEERING, and also be the means of devising some remedy to obviate such evils.

An engineer in charge of a consolidation engine, whose firebox hung between the frames, made a report of the ends of the spring over the back-driving wheel chafing the shell of the firebox. The inside of the spring's saddle was raised up so as to tip the ends of the spring away from the boiler. The result of this change was the driving-box running very hot. No amount of care and attention would induce it to run with any degree of coolness again. Finally water was piped from the tank to prevent the waste in the cellar from catching fire, hoping that it would presently come down to a "bearing," but it always proved treacherous thereafter.

When the engine was sent to the back shop for general repairs, it was discovered that the end of the brass next the firebox was completely worn out, while the end near the hub of the driving-wheel had a good margin for wear left. A careful inspection of the journal proved this part to be also unevenly worn, as there was a difference of nearly three-eighths of an inch in the diameter of the journal. The reason assigned for this peculiar wear was that the heat from the firebox was the chief cause; but this was easily refuted by referring to the condition of the opposite journal, which was worn with imperceptible evenness.

Another engineer in charge of the same kind of an engine reported that the tire of the main driver was cutting the spring strap. The saddle under this spring was lined up so that it tipped the spring away from the driving-wheel. This journal commenced to run hot on the next trip, and thereafter gave much annoyance. Packing the driving cellar frequently did not have the soothing effect it should have. An inspection of this journal, after the engine went to the back shop, showed the wear to be greater next the hub.

Calipering several journals, taken from under different kinds of locomotives, showed a great diversity of diameters. Few journals on the same axle wear with any degree of evenness. Those peculiar features may be attributed to the inequality of weight due in the rigidness of the spring appliances.

It would seem a convex and a concave surface for spring bearings would give the springs the freedom of adjusting themselves so that the weight would equalize on the driving-boxes under varied conditions.

JAMES FRANCIS.

Carbondale, Pa.

Railroading in Sweden.

Thinking that it will interest your readers to see how the locomotives look in Sweden, I enclose photographs of some engines belonging to the State Railways. These railways have 2,297 miles of track. The remaining 4,323.4 miles belong to private roads. The State Railways, and partly the private railways, are standard gage, 4 feet 8½ inches.

At the end of 1898 the State Railways possessed 502 locomotives of forty different classes. This year the number probably will run up to 600. The photographs show some of the most common types. Their general dimensions I have joined together in a table.

Fig. 1, No. 352, of the class "D," is built by the Motala Mek. Verkstad, Sweden, 1887. Class "D" embraces fifty-three engines, of which eighteen were constructed by A. Borsig, six by Nydkvist & Holm, Sweden, and the rest by Motala Mek. Verkstad, in the years 1874-91. The engines are used in passenger and light goods service.

Another class is "Cc," built by Nydkvist & Holm in 1900. At the end of 1898 twenty-seven engines belonged to this class. They were all built by the same firm, Nydkvist & Holm, 1892-98. Since this time a great many more locomotives, class "Cc," have been built; most of them also by this firm, and some by Motala Mek. Verkstad. The engines now work most of the heavy express trains and passenger trains.

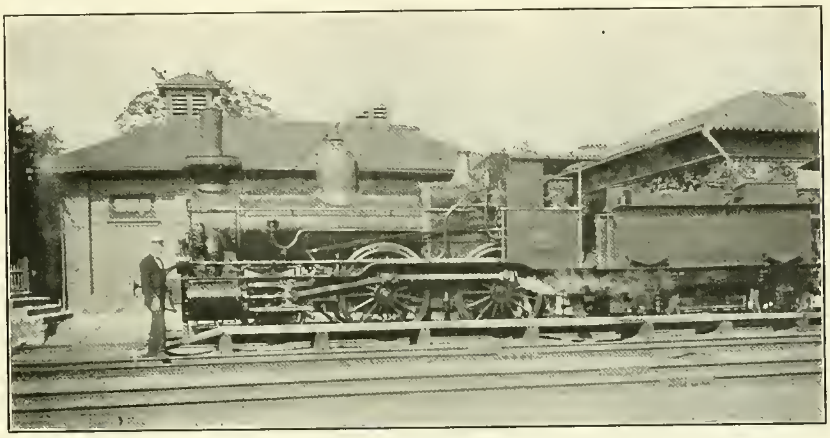


FIG. 1. SWEDISH LOCOMOTIVE.

FIG. 2. SWEDISH LOCOMOTIVE.

Class "Kd" was built by Motala Mek. Verkstad in 1897. This class embraced at the end of 1898 seventy-three engines, all built in Sweden, by Nydkvist & Holm (twenty-two), Motala Mek. Verkstad (fifty), and Kristinehamns Mek.

Verkstad (one), 1890-98. A great many engines have been built of this class since 1898. They are used in goods service.

Fig. 2 shows one, No. 585, of ten engines, class "T," built by Richmond Locomotive Works, 1899. They are also employed in goods service.

For heavy trains they double-head. The maximum speed on the main lines is 85 kilometers an hour. New 80-pound steel rails are laid down on the main lines, and then the speed will be increased. The State Railways are also constructing heavier passenger and goods engines.

ERIK SNALL.

Skofde, Sweden.

GENERAL DIMENSIONS OF ENGINES, SWEDISH STATE RAILWAYS.

CLASS	A	D	Cc	KD	T
Cylinders, diameter and stroke, inches	15 x 20	15½ x 18⅛	16½ x 22	17¾ x 22	20 & 31 x 24
Drivers, diameter, inches	74	61½	74	54½	62
Steam pressure, lbs	128	142	142-180	142-180	180
Total heating surface, sq. ft	850	845	1,095	975	....
Weight on drivers, lbs	26,900	51,156	57,770	80,262	86,877
Total weight of engine, lbs	55,125	73,650	89,743	80,262	121,562
Total weight of engine and tender, lbs	115,320	118,408	160,965	128,331	187,425

The Passing of the Diamond Stack.

The diamond stack, that within the memory of the majority of engineers in service to-day was the only one, and which is, by the way, regarded by many of them as the "only stack" yet, is now almost a relic of the past. Though never a thing of beauty, it had some features to its credit, and in a competitive test to-day would, without doubt, prove its superiority as a steam producer over its more graceful successor, the straight stack. It made steam with almost any quality of and, it may be added, almost any quantity of fuel, so that enough was supplied; and yet, in spite of such important advantages, it had to make way for the straight.

Nor were the mechanical difficulties the only ones experienced in effecting the change. Fire insurance companies compelled to pay claims on property near the line of a railroad thought they saw in the contrast between the two types of stack used on locomotives an opportunity to shift their burden upon the shoulders of the railroad company, by aiming to prove that one or the other was an inferior type for preventing the emission of sparks from the locomotive in such quantity and condition as to unnecessarily endanger property adjoining or in close proximity to the railroad, and they succeeded, at least in such measure as to prove a source of no little annoyance and expense to the railroad companies who happened to be using both types of stack. If an engine having a straight stack happened to pass some point about the time a fire started anywhere within reasonable, or even unreasonable, distance from the railroad, an effort would be made to prove it to be the inferior type. If the engine happened to have a diamond stack, the same effort would be made to prove its inferiority. However unfair or unreasonable the plaintiffs, it must be said they were extremely impartial, as they attacked either type with equal vigor, just as it happened to suit their case, and even to-day we occasionally meet with cases of that kind.

It is the practice to call engineers to testify in court as to the merit of both types of stack. If they claim no advantage for either, in so far as fire-throwing is concerned, they are confronted with the question: Then, why are the two types in use? Inability to answer this question is not only confusing to the witness, but also tends to weaken the force of other testimony he may have given, however correct it may have been; and the railroad company, temporarily at least, must suffer the disadvantage of his failure to give an intelligent statement on a subject with which he may reasonably be supposed to be familiar. That is a state of affairs that need not exist, and for the benefit of those who have not given the matter much thought, we will look into the real cause for the existence of the straight stack.

The period is yet within the memory of the writer when the heads of the motive-power departments came to the conclusion that the rapidly increasing train-weight and demand for higher speed were such that some means must be employed to relieve the valve gear of a portion of its overload, which, with the high steam pressures required to meet the conditions imposed upon the engines, was producing anything but satisfactory results. Hot eccentrics, broken straps, slipped blades, broken rocker arms, valve yokes, etc., were becoming decidedly numerous, and the frequency of these failures made it extremely necessary that a remedy should be supplied, so Dame Necessity, that prolific parent of invention, brought forth the balanced slide valve. It served the purpose intended admirably; failures from broken or distorted valve gears grew incomparably less; but for a time it proved an expensive remedy. When perfectly clean and well lubricated, it was all that could be desired; but the trouble was, to keep it in that condition, for, when dry or dirty, the strips or rings, or whatever kind of joints it had, would blow, until the waste from that source made the remedy almost as great an evil as that which it was calculated to remove.

The reader is here reminded that during the experimental stages of the balanced valve, the diamond type of stack was the only one in general use, and the failure to operate the balanced slide valve successfully was found to be due to the peculiar construction of the appliances used with that kind of stack. The low nozzle exposed the valve too much to the smoke and hot gases of the front end, which would enter the steam chest whenever the engine would be shut off, and sparks on their way through the stack, a number of which was always contained in the bonnet while the engine was working, would at such times fall into the nozzles and find their way perhaps into the steam chest, making it impossible to keep the valve clean or properly lubricated.

The straight stack, with its higher nozzles and unobstructed passage for sparks through it, proved to be an efficient substitute for its homely predecessor, and a factor of no little importance in the successful operation of the balanced slide valve.

The fact that it is usually found set on an extended front is likely to cause the impression that its adoption is chiefly due to its fitness for use in connection with the so-called spark-arresting front end. It certainly seems to be the most suitable design to use on the extended front; but its usefulness in that direction is of secondary importance only, especially so since the attempt to arrest sparks has been abandoned; and in spite of its cleaner service as regards the comfort of those riding behind it, together with its reduced first cost, it is safe to say that, were it not for the fact of its being such an important aid to the successful operation of the balanced slide valve, the much despised diamond stack with all its ungainliness, would to-day adorn the front ends of a large majority of our locomotives.

Bellevue, O. THOS. P. WHELAN.

Engines for Fast Passenger Service.

There seems to be quite a discussion in various quarters as to the best engines for fast passenger service, and the Atlantic type seems to catch most of them just now. The latest suggestion is a ten-wheeler, and I haven't quite decided whether this is meant as a joke or a reality.

Fast trains make few stops—in fact, run from 50 to 150 miles without making a station stop; and as they are running practically all the time, the engine that will run with the least friction is the best one for this service. A train rarely slips after it is under way, and so for tractive purposes the main pair of drivers is all that is needed—the others become mere carrying wheels. But having the side rods, there is more friction in every way for them, and they will not run as freely as the single-driver engine.

Take a train like the Empire State Express, which does not stop between New York and Albany (145 miles). A single driver will start the four cars almost as readily as the four-coupled engine, and will certainly keep them rolling just as fast, or faster, after they get under way. But allow that they do not start quite as readily—that they take a half minute or a minute longer to get under way. What does this amount to in 145 miles as compared with the reduced friction due to absence of side rods on the numerous courses.

With a heavier train—say of seven or eight cars—and more frequent stops, the four-coupled engine has every advantage; while for very heavy trains, such as the Southwestern Limited, with from twelve to sixteen cars—the ten-wheeler has an excuse for passenger work. But for really fast trains there is no engine that can compare with the single-driver engine, unless it is a hilly road, and very fast trains and heavy grades do not generally go together. There are one or two exceptions, however, and for these I would not advocate a single engine.

But ten-wheelers and very fast trains do not seem to have much in common when we are talking of designing engines especially for this service, although there are many cases where they are doing excellent work.

"Every man to his trade," says the adage, and likewise every engine to the work for which it is best adapted.

FRANK C. HUDSON.

Tombstone, Ariz.

A Lazy Man's Headlight.

The thin coating of silver that is put on headlight reflectors soon wears off and shows the copper under it. This spoils the reflector for sending the light ahead. It is the rule that the reflectors are not replated as soon as they need it; but when they get so bad they are useless.

Then the pool system is hard on reflectors. No one takes any interest in their being in perfect order. If it is necessary to clean one, it is usually scoured well, instead of being cleaned carefully so as to preserve the silver coating.

Long years ago when the silver got worn off, we used to see the inside of the reflector painted a pure white, laid on smoothly with a soft brush, so the paint would cover well without any streaks. This served the purpose fairly well. Pure white is said to absorb less light than any other color, and therefore reflects more. Silver is white, and for that reason is used for a reflector. These painted reflectors were easily cleaned with soap and water or a piece of cloth with kerosene. We used cloth so no threads of waste would stick on the reflector.

Of course, this was a make-shift to help out till such time as the reflector was replated; but some of these reflectors were in service for years.

I do not see why the reflectors cannot be made of a little thicker material, say pressed steel, 1-16 inch thick, and enamel the inside pure white. This kind of a reflector would not get any dents or scratches in it with ordinary service. Sulphur gas from coal smoke would not tarnish it, as it does silver. When it got dirty or smoked up, it could be cleaned as easily as the glass in the front of the case. Such a reflector would last almost indefinitely, barring smash-ups, and would fit the pooling system first rate.

But while we are talking of headlights, I would like to know of what use the ordinary oil lamp is to a man on a fast train. You cannot see anything far enough off to much more than shut off and smash the brake valve over to emergency before you are into the obstruction. They do fairly well when you are moving slowly. About four telegraph poles space, or forty rods, is as far as you can see a switch target or a box car, unless they are freshly painted, so that the paint glistens. We should have a light that will show an obstruction far enough off to give a man room to stop in or brake the speed down slow enough to save damage.

I have tried electric headlights, but the first ones which came out, some ten years ago, gave so much trouble that they did not last long. They were too powerful for that age and generation and blinded everybody except the man using them. It took an electrical and mechanical expert to keep one in order.

The ones now in use do better, provided you have a good steaming engine. If the engine doesn't steam free enough to pull the train, run the air pump, the steam-heat system and the electric headlight, trouble is on hand surely. If there is any other way to make the electric current for the light with a smaller expenditure of live steam, it will help out the headlight.

They are lighting the passenger trains with electricity, using a dynamo run from the car axle, which pumps the "juice" into a storage battery all day long, if the car is running, and has a supply at night to light up the car. Now, to my mind that is like a small air pump working into a very large main reservoir. It does not take as much steam to run the small pump, but if the pump runs both daylight and dark, and the main reservoir is only drawn on in the night time, it will hold up the pressure.

If trainmen and car repairers can operate this sort of a passenger car light between terminals, on the trip, I do not see why the "eagle eye" can't be trusted to do it on an engine.

Very likely this opinion will draw the fire of the electric-light men, but it will give them something to think about.

JOHN W. TROY.

Indianapolis, Ind.

Short vs. Long Stroke Engines.

In the October issue our old friend De Sanno takes up the cudgel for the short-stroke engine, and proceeds to show why the modern tendency for long stroke is all wrong.

I don't quite agree with him on this point, and don't think all of his arguments will hold water. His reference to the unmechanical appearance of the rods on long-stroke engines reminds me of some of the statements showing the advantages of the wide firebox, which you rip up the back so thoroughly in the same issue. They both seem to be a case of vivid imagination.

The difference between balancing a long and short-stroke engine is not so great as might appear on the surface, for the increased diameter means a heavier piston head and a heavier piston rod, which must be balanced for reciprocating weight. This extra weight will go quite a way toward making up for the increased velocity. Then the question of frame is also to be considered. As you increase the diameter of your cylinder you also increase the push and pull on the frame, whereas by lengthening the stroke you do not affect this in the least.

Solid-end side rods rarely break, and if they are heavy enough they surely will not. And aside from the extra weight, why should they heat more on long than on short-stroke engines? With the same diameter of wheel, does the crank-pin turn in the brass any faster with a long than with a short stroke, and isn't it the turning of the crank pin in the brass that causes the heating?

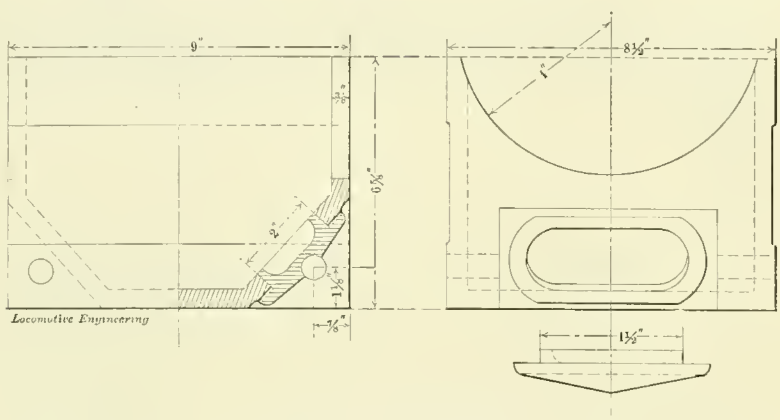
When it comes to heavy driving wheels, I'll shake hands with brother De Sanno every time. It's the flywheel effect, and it's a good thing to have when you can. In most cases, nowadays, they are cutting the weights of parts down, so that drivers have to be steel, and light—most of the weight goes in the boiler.

But I'm a believer in heavy driving wheels, for several reasons. It steadies the engine; it puts the weight where you want it—on the track—and it does not add to the weight on journals, but rather lessens it.

By the way, Mr. De Sanno, I understand one of the main rods on Mr. Prince's engine let go, even if it was short stroke.

FRANK C. HUDSON.

Tombstone, Arizona.



DRIVING BOX CELLAR.

Convenient Driving-Box Cellar.

Referring to the cut of cellars which appeared in September issue of LOCOMOTIVE ENGINEERING, will say that while your readers are interested, I may contribute something that I believe has the advantage over the Symons cellars, as I think it a hard matter to pack the main journal with the Symons device, as the eccentrics come close to the box in most engines. I enclose sketch of a cellar which I saw on passenger engine No. 905 of the Illinois Central. The figures may not be correct, but they are near enough to show the idea. The lid or hand hole plate was in the angle or throat of cellar, clear of all obstruction, and held in place by the cellar pin. The engineer did not know whose get-up it was. I made further inquiries, with the same result. I don't know whether any more are in use, but I thought it a simple device and worthy of notice.

JAMES M. BURGWIN.

South Chicago, Ill.

Railroading in Early Days.

BY WALTER S. PHELPS.

In 1848 Edward S. Norris, of Bush Hill Works, Philadelphia, Pa., under arrangement with citizens of Schenectady, N. Y., entered upon construction of locomotives at Schenectady, N. Y., and built several. I believe the first wrought-iron driving wheel constructed in this country was made by this firm for the Syracuse & Utica Railroad Company (Mr. David Henderson Beggs, master mechanic). It was upon the French principle of motion work; the wheels were 7 feet diameter. The engine was called the "Lightning"—for fast express train duty. It was a failure as regards lasting qualities or durability. The Schenectady firm also made for the same company the two engines, "Diomede" and "Achilles." They failed to give the satisfaction that Rogers locomotives gave, being continually in the shop. The poor construction soon became embarrassing to the Norris firm and caused a suspension of construction and wound up the affairs of Edward S. Norris.

After passing through the courts and cleaning away the *debris,* the reorganization took place with, John Ellis, president; Mr. Atwood, secretary, and Walter McQueen, general superintendent. As Mr. McQueen was master mechanic on the present New York Central at Albany, upon the starting up of the present Schenectady Locomotive Works, James Perry, who had seen service under James Milholland at Reading, Pa., was placed in charge, acting for Mr. McQueen in constructing the first lot of locomotives.

During the interim of idleness of these works (or in 1850) the writer engaged with the president of the new Milwaukee & Mississippi Railroad Company to take west two locomotives Mr. Kilburn purchased of John Ellis in Schenectady, being the first engines to go west of Lake Michigan. At this time the Chicago & Galena Union Railroad Company was formed, and William B. Ogden was made president. In August of 1850 I left with the "Milwaukee" and the "Mississippi" for Milwaukee. At Buffalo, N. Y., these engines were hauled through the streets to Tonawanda Creek and loaded by a Mr. Bartholomew—one on the brig "Abiah," the other on the schooner "Patrick Henry." I took C. M. Reed's line of steamers around the Lakes (a ten days' journey), and on arrival awaited the coming of the locomotives.

The first vessel to arrive was the "Abiah," upon September 12, 1850. Three days were spent by Captain Hawley in dredging the river in order to reach the mouth of the Menomonee. These engines were put off the vessels by the writer and his assistant, Henry Morris, now a farmer at Vernon Center, Blue Earth County, Minnesota, and where now stands Armour's building, of packing-house fame. On Saturday, September 18, 1850, the engine "Milwaukee" was ready for firing. The track was laid through Plankington's lumber yard, across West Water street to a shed, and the engine was run over by the writer, where about 800 feet of rail was laid down by the contractors, and the first locomotive passed back and forth with E. D. Holton, Garrett Vleit, D. H. Richards, Jasper Vleit, assistant to the president, with their wives—the first named being the directors of the road. I remained until spring, returning to Schenectady to erect the "first locomotive," named "Great Western, No. 1," under the new reorganization, or present Schenectady Locomotive Works. Among the workmen were four mechanics, who afterwards became masters of machinery, one on each of the following roads: Wm. McPhail, on Ft. Wayne & Cincinnati; Samuel Willmot, on Michigan Southern and Northern Indiana; Reuben B. Snyder, on Houston & Texas Central, and his brother, Maybery B. Snyder, on a Minnesota road from Mississippi River west.

The "Great Western" being erected, I was sent to Canandaigua with her and put her on the 6-foot-gage road to Penn Yan and Jefferson, and ran her there until ordered to take her to Susquehanna depot and deliver her to the New York & Erie Railroad Company. Returning to the works, I took engines to various roads in the States of Ohio, Indiana, Iowa, Wisconsin, Canada, outside of New York State. In Canada I was ordered to remain, by request of John T. Clark, chief engineer of the Great Western Railway of Canada, where in after years I ran engines built by Lowell, Amoskeag, Norris, of Philadelphia; D. C. Gunn; engines built in Hamilton, Canada; engines built by Jones of England, Birkenhead, Slothert & Slaughter; engines of Bristol, England; George Stephenson, of Newcastle-on-Tyne; John Fowler, of Leeds; Wm. Fairbairn, of Manchester, and others built by Richard Eaton at Hamilton, Canada—mostly inside connected. It was while there the link motion was devised, and I admired its qualities over the V-hook I had been running, and with which I ran the opening train on that road on January 17, 1854, with the engine "Sampson, No. 2," built by the

Schenectady Locomotive Works, after the laying of 229 miles of track from Windsor to Niagara Falls, *and not losing a day for repairs during the construction,* which completed the line and connection from end to end, at 11 o'clock at night, near Longwood station, January 16, 1854. The fireman upon that occasion—John Kettlewell—is at the present writing employed at the Dillon street shops of the Big Four, in Indianapolis, Ind. The conductor—Hanon H. Stanton—died two or three years ago at Bakersville, Cal., after being a conductor on several railroads out of Detroit, Mich., in passenger service.

Down to the breaking out of the war, in 1861, I had handled many engines in various parts of the railroad service, from construction on Wisconsin railroads and Canadian roads, through freight and passenger service—some where the engineer was on the left-hand side, as the Birkenhead engines of England; one which I ran for nearly two years in Canada, before I left for the States, and the old Indiana Central road from Indianapolis to Richmond, in 1862 and 1863, where I operated as engineer on freight and passenger trains running Baldwin engines first, then a James Souther (South Boston) inside-connected engine on passenger train, making daily trips between Indianapolis and Columbus, Ohio, 188 miles.

Two Old Locomotives.

I find among my snapshots two old locomotives, or front portions of them, which may be of interest.

No. 1 is an old Milholland, showing the round bar-guides of the crosshead and the forked front end of main rod to go around crosshead. This gave two bearings on the front end of main rod. I often hear round guides suggested as not holding dirt and cinders as a flat guide does. This is true—but it doesn't hold oil either, which caused them to be abandoned years ago. There is a kind of packing arrangement for each guide.

Fig. 2 is the front portion of an old Cooke locomotive on the Delaware, Lackawanna & Western Railroad. The peculiar part is the auxiliary slab frame running back from the cylinder and guide yoke. The back end was connected to main frame by a bent arm, which can just be seen going in between the wheels. This frame was for the purpose of attaching the pump, which was driven from the crosshead. R. G. Winters.

Kingston, Pa.

A man with a pair of stocks and dies may cut, by hard labor and at a low rate of wages, the threads on 100 ⅝-inch bolts in ten hours; but give him a modern screw-cutting machine and he will cut 4,000 in the same time, cut them better and with very light bodily exertion.

A Defect Report.

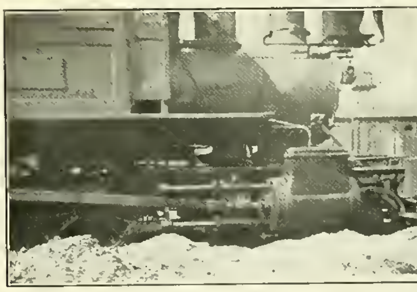
On one of the Western lines where an engine failure from a breakdown makes bad work on the busy line, the master mechanic of one of the divisions keeps a little record book of defects that are not ordinarily seen, but which would have caused an engine failure sooner or later if not found and repaired—generally sooner than later. Small cracks in straps or in the motion work, flaws in wheels or journals, loose pins, cracks in spring hangers, etc., are here recorded, and the name of the man who first located the defect is shown in the report book. Of course, the regular inspector finds a large share of these defects, but enginemen, roundhouse repair men and wipers also have a good many to their credit.

The original intention was to keep a record of cracks and flaws, so as to know something of how many could be discovered *before* the breakdowns instead of after; but when credit was given to the men who first located these defects, they all began using their eyes to good purpose. This plan is used by one of Locomotive Engineering's patrons, who is too modest to have his name published.

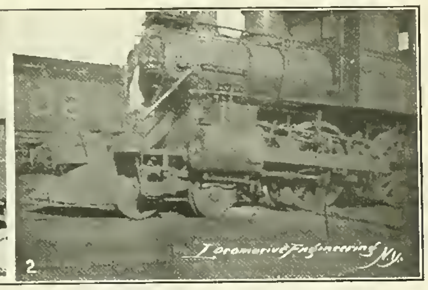
Diverse Classes in Our Own and Foreign Cars.

A great many Americans pride themselves on the fact that there is only one class of passenger car, and rich and poor must use it in common. This is true of trains for short journeys and local traffic, but it does not apply to all kinds of trains. When the existing conditions of travel are examined, it will be found that we have as much diversity of class as there is among travelers on foreign railways, with the difference that on our trains composed of inferior cars the passengers have to pay about as much as those who travel in the clean, luxuriously fitted cars do. Some experience with the way that passengers traveling on foreign railways are charged according to the class of accommodation furnished inclines us to believe that we have no reason to be proud of our aristocratic pretensions.

Most of the European railways carry three classes of passengers, but those in Prussia and Saxony carry four. In Würtemburg you can buy a ticket good for fifteen days which is a general pass over the railways of that kingdom. A third-class ticket of this kind costs about



OLD MILHOLLAND.



OLD D., L. & W. ENGINE.

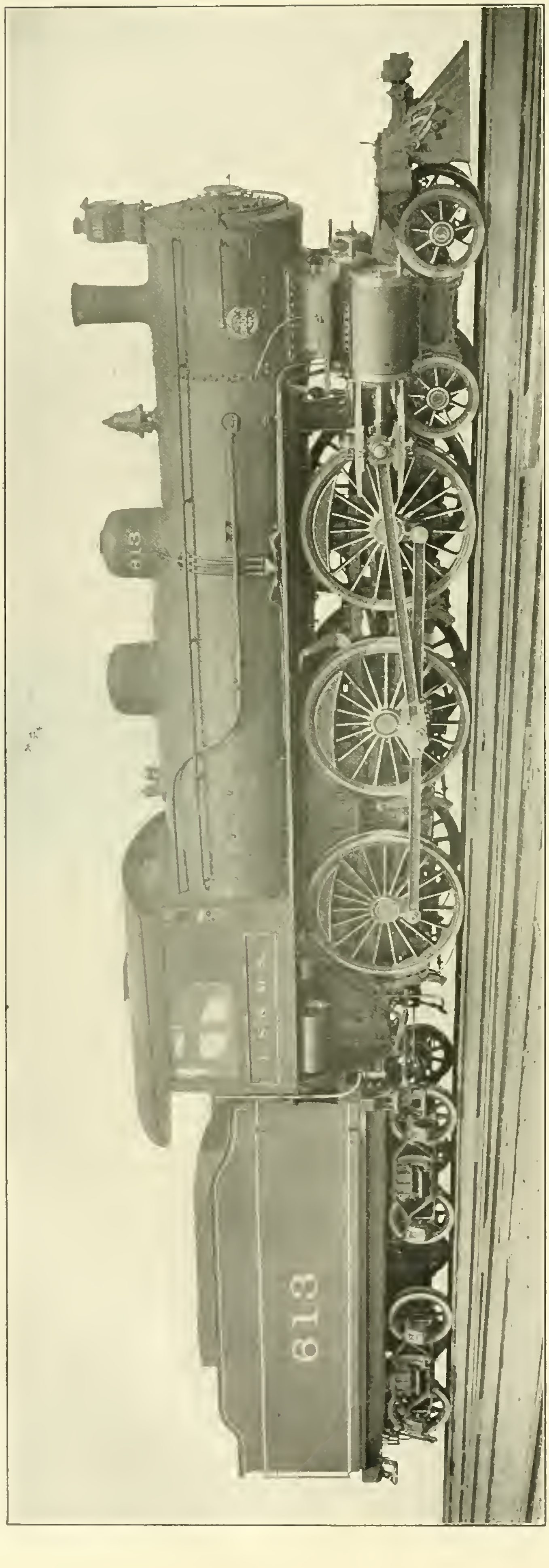
At this same place, all rod straps are wiped clean and then struck on the edge of the work bench, like a tuning-fork, to spring them a little. One or two jars will reveal a crack, if one exists, as the oil will show out of the crack on the clean surface.

On one of the Eastern roads they adopted the plan of testing the main rod straps each time the boiler was washed out, about once in ten days. They found from two to four cracked straps each month, which might have run for months, and possibly for only a few hours. About eighty engines ran in and out of this point.

Some years ago we used to hear of a custom of rewarding an employé who located cracked side rods and straps and such other defects as were obscure, provided that it was an employé whose direct business was not in that line, such as a wiper or repair man. The inspector or engineer whose business it was to locate these defects did not share in any reward, for it was his regular business to look for defects. Possibly this practice could be revived with good results and prevent failures that could be located by a close inspection.

five dollars, which makes traveling indeed very cheap, for with it a passenger can travel as often as he likes, stop where he likes, or travel continuously if he likes, within the fifteen-day limit. In Switzerland, where the main lines of travel have recently come into the hands of the government, a similar pass is issued. A passenger desiring any of these tickets has to have his photograph affixed to it to identify him and prevent transfer. A fifteen-day ticket, third class, costs something over five dollars, but it will take you practically all over Switzerland. Baden has mileage tickets, covering 1,000 kilometers (660 miles), a trifle dearer, third class. They are good for any members of a family or firm, and the rate by them comes to about a cent a mile.

The old 900-pound bell which has hung in the belfry of the Lackawanna shops, in Scranton, for the last thirty-four years is now in a different service. It was saved from the scrap-heap by a committee from the Church of Peace, on the South Side, and will hereafter do duty on Sundays only.



BROOKS TEN-WHEELER FOR LAKE SHORE & MICHIGAN SOUTHERN.

Marshall's Express Ten-Wheeler.

The handsome engine hereby shown is one of a group recently built by the Brooks Locomotive Works for the Lake Shore & Michigan Southern Railway. The engines are very powerful, and were designed by Mr. W. H. Marshall for the purpose of hauling the very heavy fast passenger trains that are now run over the Lake Shore Railway.

The engines have cylinders 20 x 28 inches, driving wheels being 80 inches outside diameter. The boiler is 66 inches diameter at the smallest ring and carries 200 pounds working pressure. The total weight of the engine in working order is 172,500 pounds, of which 135,000 pounds are on the drivers. The tractive power is 23,800 pounds, and the ratio of traction to adhesion is 5.7.

The engraving gives such a good idea of the appearance of the engine that little description is necessary.

Exhibit of the American Steel & Wire Company at Paris.

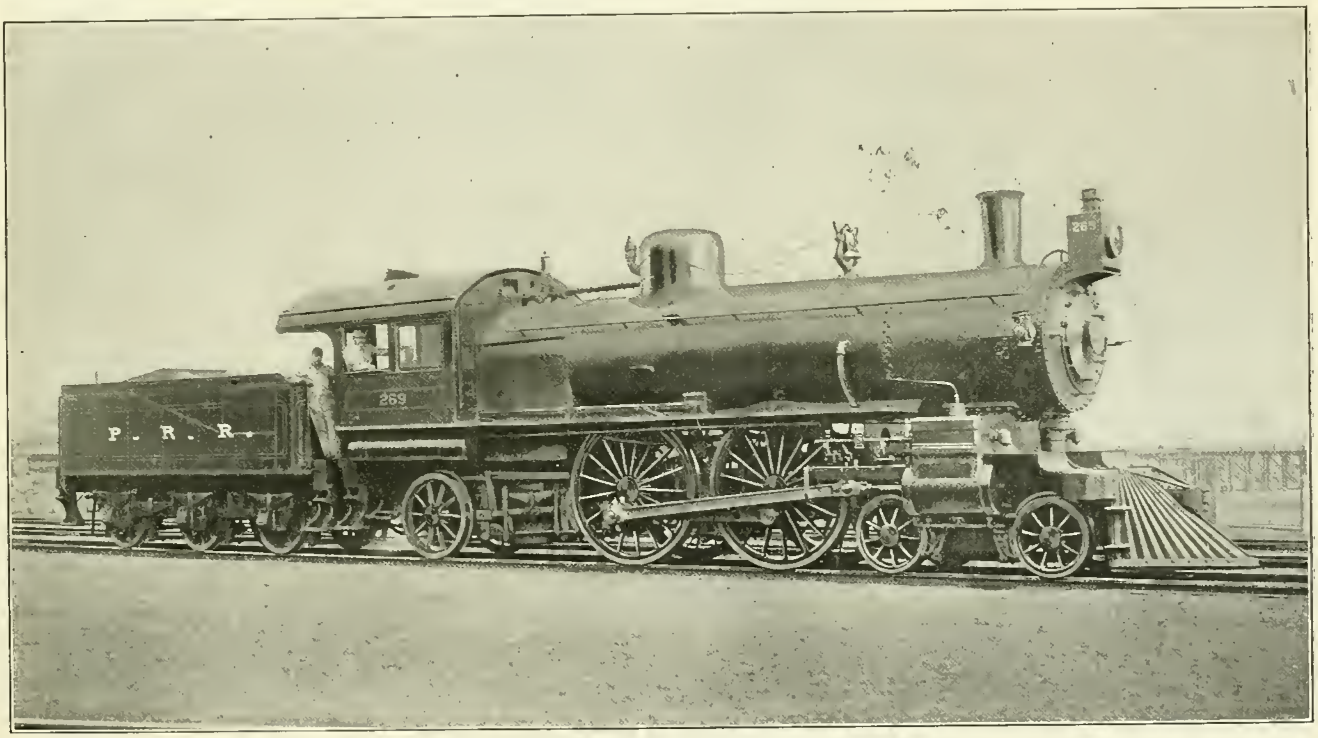
The American Steel & Wire Company have a very complete exhibit at the Paris Exposition. It comprises iron ores and coal from the company's mines in Michigan, Minnesota, Wisconsin and Pennsylvania; limestone from their quarries; coke from their ovens; pig iron from their blast furnaces, the quality and nature of the pig iron being illustrated by fractures. Ingots, blooms and billets from Bessemer and open-hearth steel mills are also shown. In the center is an ornamental bronze pagoda with art-glass roof, in which pagoda are panels illustrating various manufactured products, such as sections of beams, channels, angles and bars, sections of shafting, rail splices and frog filling; horse shoes, spikes, nails and tacks, barbed wires, bale ties, fine copper wires, music wires, fine spooled wires, all sorts of chains and rivets, coiled, spiral and flat springs, clock springs, wire ropes, insulated wires and cables, sections of submarine cables, etc.

In the space surrounding the pagoda are samples of sheet steel with illustrations of quality in the shape of cold bending and stamping tests, large steel boiler heads, many bundles of woven wire fences and galvanized poultry netting. Piled in attractive pyramids are wire rods, steel and copper wire in bundles and on reels, copper trolley wires, weatherproof and lead-encased cables, copper rail bonds, wire ropes and so on, *ad infinitum*. The astonishing feature of the exhibition is the great variety of products shown. The entire range of the steel-producing industry appears to be covered by the products of this company, which is popularly, but erroneously, supposed to be confined to the wire industry. Needless to say, they secured numerous awards, there being eight grand prizes and four gold medals falling to their lot.

A Bit of History.

That little things often affect large enterprises is shown by the following scrap of history connected with the building of the Boston & Providence Railroad. There was quite a strong opposition to the building of this road, and the late William Raymond Lee, the first superintendent of the road, said: "It is a historical fact that certain contractors were assisted by advances of money by the late Ebenezer Fisher, Jr., who was cashier of the Dedham Bank, he knowing them personally to be men of integrity and ability." Mr. Lee further stated that "had it not been for Mr. Fisher, the Boston & Providence Railroad would not have been built at that time."

Mr. Ebenezer Fisher was the grandfather of Mr. Herbert Fisher, of Taunton, Mass., who occasionally contributes to these columns.



NEW PENNSYLVANIA LOCOMOTIVE—CLASS E-2.

New Pennsylvania Locomotive—Class E-2.

The Atlantic type engines built last year by the Pennsylvania Railroad, and known as class E-1, have been doing good work; but the separation of the engineer and fireman was not satisfactory, and the design was modified so as to remedy this, and change a few other details.

The new engine, No. 269, is known as class E-2, and by narrowing the firebox they have placed the cab at the back end, and the sloping boiler head gives a fairly roomy cab.

They have reduced the firebox, so that instead of 69 square feet there are 51 feet of grate area. The heating surface is increased from 2,320 to 2,430, as the flues are longer—15 feet between tube sheets—but are 2 inches instead of 1½ inches in diameter, and no combustion chamber is used. It is said to maintain steam much better on long runs than the E-1.

The cylinders and drivers are the same, 20½ x 26 inches; drivers, 80 inches. Trailing wheels are reduced from 56 to 50 inches and are placed farther back, having radial boxes; while the whole engine is 3 feet 5 inches longer than the E-1, which was 38 feet 1 inch from point of pilot to back face of cab deck.

The engine is doing remarkably good work and handles heavy trains in very fast time. It has hauled fourteen cars 58 miles in 62 minutes, and has no difficulty in making better than a mile a minute with the St. Louis Limited, which has twelve and thirteen cars. The official weight has not been taken, but it is estimated to be about 180,000 pounds. With the 185 pounds of steam carried, the tractive power will be about 21,000 pounds.

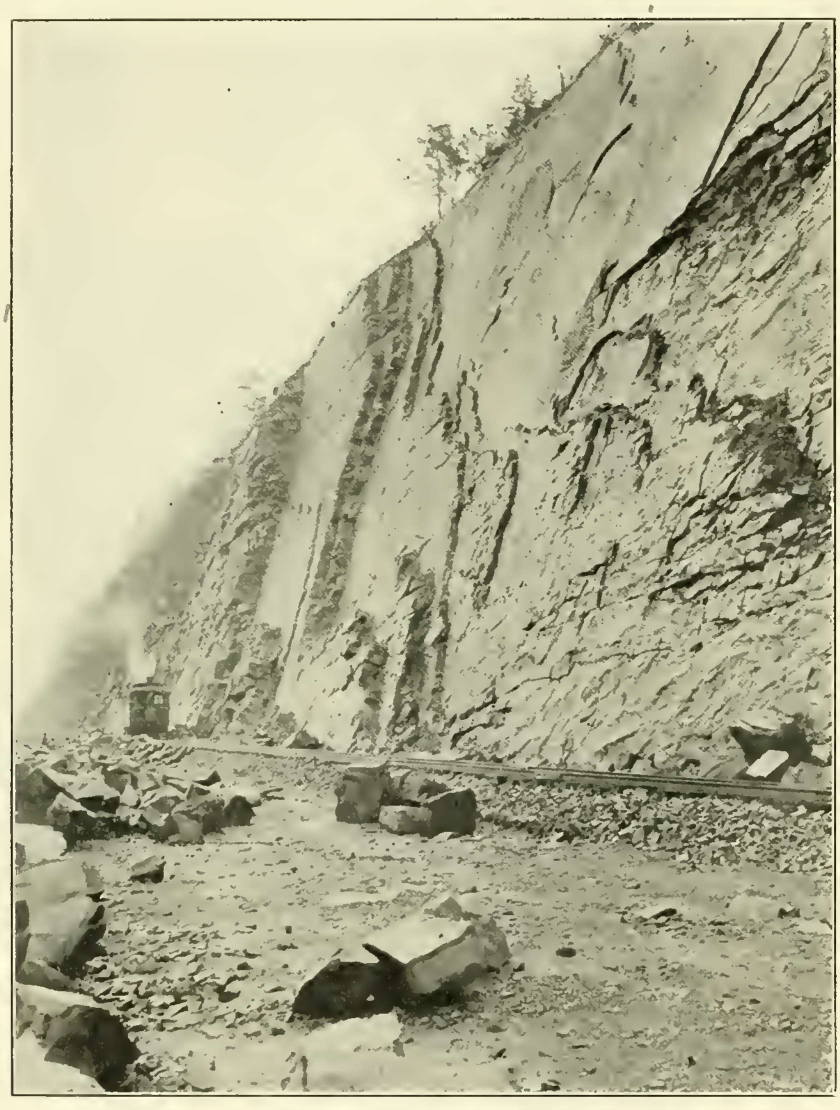
Gas, Gasoline and Kerosene Engines.

The internal-combustion engine admits of a range of temperature which would be physically impossible in a steam engine, involving a thermodynamic efficiency far in advance of the most perfect steam engine. Various forms of fuel have been used in these engines, including natural and manufactured gas as well as liquid fuel and powdered coal. As gaseous fuel is most commonly used, the internal-combustion engine is ordinarily known as the gas engine. Where gas is not available gasoline is generally used as a substitute. A good gas engine of medium size uses 1 pound of coal converted into gas per horse-power every hour. Expressed in percentage of efficiency, even the smallest gas engine has the efficiency of the largest triple-expansion steam engine, this efficiency increasing with the size of the engine until we reach 25 per cent., in the case of ordinary sizes, and 30 per cent. in the larger sizes, or let us say from 2½ to 3 times the efficiency of the largest and most perfect steam engines. Or, comparing gas engines with ordinary stationary steam engines of equal power (which is a fair comparison), the gas engine has shown a working efficiency four times greater than the steam engine. When we bring the steam engine to account and compare carefully its consumption of fuel with its work done, we find that "steam power" and "power waste" are interchangeable terms. Thus a consumption of 1½ pounds of coal per hour per horse-power is regarded as an exceedingly good performance in a steam engine, yet it means a utilization of only about 12 per cent. of the total quantity of heat generated by the burning of coal; with 6 pounds of coal per hour per horse-power (which is about the average consumption in medium stationary steam plants), there is only a utilization of about 3 per cent. of the total heat energy.

The best steam engines are very nearly as economical as any heat engine can be with the limits of temperature at which they receive and reject the steam. In design and construction it is believed there is no great room for improvement. Mechanically the steam engine is nearly perfect, but so much the worse for the steam engine. Its possibilities are limited by the fact already shown, that in any heat engine the amount of heat transformed into mechanical power depends on the limits of temperature between which the engine works. The gas engine, on the other hand, has the important advantage over the steam engine of possessing greater efficiency, as well as occupying much less space, owing to absence of boilers with pumps and feed-water heaters, and also costing far less for attendance, inasmuch as the fuel is automatically supplied. The steam engine, as a prime mover, for the generation of electricity is so wasteful and the process from coal at the furnace to electric energy at the dynamo is so protracted that Edison and others are now endeavoring to obtain electricity from coal by some quicker and more direct method. It is not too much to say that a combination of the internal-combustion engine with a dynamo offers the best solution yet presented of an almost instantaneous conversion of the potential heat energy of fuel into electro-motive force.

The fact that the gas engine requires a special fuel, usually costly, and sometimes not obtainable, has been a serious drawback to its more general introduction. An important advantage of the steam engine is its flexibility in the matter of fuel. Every form of combustible—gaseous, liquid and solid—is being used for the generation of steam, viz.: coal, screenings, coke, breese, lignite, bagasse, sawdust, shavings and even straw.

The ability to use some cheap fuel *everywhere obtainable* would remove at once the serious limitation to the usefulness of the internal combustion engine inasmuch as it would permit the internal combustion engine to become a universal power. A careful investigation of the fuel question has led to the conclusion that commercial mineral oil, popularly known as kerosene, includes all the essential qualities of a satisfactory fuel; in fact, considered solely as a source of power for general use kerosene oil is without a rival. It is the only known fuel combining the following advantages: (1) obtainable everywhere, (2) its cost is always low, (3) it is safe and (4) it possesses the highest thermodynamic value. One pound of ordinary illuminating oil contains three hundred times the energy of storage batteries, is fifty times more powerful than liquid air and its potential energy is ten times greater than dynamite. As a reservoir of power one gallon of oil is superior to one ton of storage battery. If air could be compressed to liquefaction and supplied gratuitously to consumers the extra cost of storage and transportation would render it inferior in economy to commercial mineral oil. In fact kerosene is simply gaseous solar energy, having the capacity of liquefying at ordinary temperatures. Ordinary domestic kerosene of 120 degrees Fahr. flash and 150 degrees Fahr. fire test has a specific gravity of about 0.785, and one gallon will equal $8.33 \times .785 = 6.539$ pounds. British thermal units per gallon $= 135.357$. The production and export of oil are constantly increasing, the United States now producing over two and a half billion gallons per annum and Russia producing nearly the same amount. Oil is also being produced in Australia, Germany, Roumania, Italy, Canada, Peru, India, Sumatra, Java and Japan. Foreign countries are now paying over a million dollars per week for American oil. The valuable properties of illuminating oil and the discovery of petroleum in large quantities in Russia and America has stimulated inventors to devise means of utilizing this enormous latent energy for the generation of power. A chemical difficulty has, however, presented itself, a difficulty that at times has seemed to be insurmountable. It is well known that kerosene is much less manageable than gas; the flame of an oil lamp cannot be increased or diminished to the same extent as the flame of a gas burner. This difficulty in the combustion of oil becomes a serious matter when oil is used for power in an engine. Complete combustion of safe illuminating oil under a constant load is easily obtained, but imperfect combustion immediately ensues when the load is changed and this increases in exact proportion to the fluctuation of load on the engine. The seeming impossibility of obtaining perfect combustion of oil has led some manufacturers to adopt gasoline as a substitute where gas is not procurable. But even gasoline is not always available, besides having such drawbacks as being lower in heat value—about 18 per cent.—higher in price—about 25 per cent.—and limited in quantity—the production of gasoline being about one-tenth that of kerosene; it is also dangerous to handle in any quantity. Being in all respects inferior to oil, it is unfitted for general use in engines of medium or large size. Notwithstanding its danger and expense, gasoline is being used in automobiles of the internal combustion type, as it is impracticable to store gas in sufficient quantity for ordinary use.—JOHN A. SECOR, at New York Railroad Club.



MERRY CUT—MERRY CREEK TO RIGHT.

Building a Road Under Natural Difficulties.

One of our Arkansas friends, Mr. Y. E. Whitmore, has favored us with two interesting views taken along the line of the Choctaw, Oklahoma & Gulf Railroad, in the western part of the State. As will be seen, they had a rocky time of it in every sense of the word. The bluff shown is part of the Fourchr mountains, and only 50 feet to the left is the Arkansas River. This point is 27 miles west of Little Rock.

The engine in the smaller view is the "Arrapahoe," which is used as an inspection car. It weighs 20 tons, has a single pair of drivers and a pair of carrying wheels front and back of the main wheels. The cylinders are 8 x 14 inches.

The smaller view shows a point known as Merry Cut, named after the creek which flows about 30 feet to the right. The mountains are a dense forest of long, yellow-leaf pine, and across the river is found the best soil in the State.

BLUFF OF FOURCHR MOUNTAIN, 27 MILES WEST OF LITTLE ROCK.

Pneumatic Tools on Bridges.

The Committee of the Association of Railway Superintendents which has been investigating the subject, says that a great deal of progress has been made in the last ten years in substituting light bridges for heavy ones and in the methods of effecting repairs on old bridges. In part the report says "that with pneumatic riveting hammers I find two men and one heater can average daily (ten hours) 550 rivets, whereas by hand 250 rivets per day was a good day's work (more often less) for three men and one heater. One day we drove 700 rivets, by using an additional man to take out fitting-up bolts, etc. This was the work of one air hammer only.

"In inspecting rivets I find the work far superior to hand work—less loose rivets, heads invariably perfect, shank of rivet filling hole, and in every way superior to hand work done by our men, or by others in the past; also work can be done readily in places where great difficulty has been experienced with hand tools.

It seems useless to call attention to the benefit of reamed holes in assembling joints made by pneumatic drills over the 'drift pin work' so much in use, where hand riveting prevails; but with the rapidity that air drills run, the expense of reaming rivet holes has been reduced to a minimum."

The compound locomotive is slowly but surely making its way in this country and every intelligent engineman wants to learn how they work. The best aid we know of is the study of "The Compound Locomotive," by Colvin. Price, $1.00.

Santa Fe Car Couplers.

A report from the car inspector of the Interstate Commerce Commission at Chicago says:

"An inspection of some two hundred Atchison, Topeka & Santa Fé cars in this yard failed to disclose a single defective coupler. Of the fifty or more cars of other owners in the yard, five were found with defective couplers, but the car repairers were after these. One car came to yard in bad order and was to go to shop for heavy repairs, but arrangements had been made to put in new knuckle to avoid using link and pin on way to shop.

"The Santa Fé have profited by the last report of Inspector Watson. Since August 14th they have had a special inspector to look after couplers. They call him 'the Interstate Commerce man.' He inspects rigidly against connecting lines who are paying heavy bills for repairs to couplers. This is the most gratifying condition yet found. It would be well to inform other roads of the good effect obtained by having a special inspector until the inspectors are educated up to the new order of things."

Locomotive Engineering

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Will Electricity Supplant the Steam Locomotive for Railroad Service?

This question, in one form or another, has been asked repeatedly and comes up with frequent regularity. The most recent occasion is a statement which has been circulated with much positiveness, that the Long Island Railroad has practically adopted a plan for the substitution of electricity for steam as a motive power. It was hardly necessary to the mechanical world for President Baldwin to deny the statement and explain that while the road was constantly considering plans for the improvement of the property, it had not yet reached the point of adopting the electric motor to take the place of the steam locomotive; but it was doubtless necessary to make suitable explanation to a credulous public.

The electric motor is not an interchangeable equivalent with the steam locomotive in all fields of railroad work. Some classes of work now done by the steam locomotive can doubtless be done more economically and more advantageously by the electric motor; while, on the other hand, the steam locomotive does work totally impossible to the electric motor, economy and adaptability considered. The steam locomotive has a field of its own, and so has the electric motor. Both have their limits. One may be found just now working in the other's field; in which event the more efficient and economical machine will ultimately prove its superiority and finally supplant the usurper.

The field of the steam locomotive is distinctly in heavy freight train service, where many tons of freight are moved in one train; and it is safe to say that the electric motor will never replace the steam locomotive in this class of service. There are two ways in which it might be attempted, but both would fail early in the experiment because of their high cost over the present economical system. One would be to use an electric locomotive which would haul the train; the other would be to equip each freight car with electric motors and operate the motors collectively from any central point, preferably the head end of the train. The first plan would require an equally heavy machine and as high horse-power as the steam system. The variation of electric pressure on the line, due to the intermittent use of the necessarily powerful motors, would make the cost of plant and operation prohibitively wasteful and high. The equipping of each car with a motor would be entirely too costly to be practicable. The long, heavy, modern freight train, with a limited crew of one employé to each eight or ten cars, is an example of the most economical long-distance transportation of freight, and one which the electric motor can never hope to reach, or even closely approach. This is equally applicable to long-distance, heavy passenger train service, where a large number of cars are hauled in each train. In short, the steam locomotive is a permanent fixture in trunk-line work, and this class of service embraces a field which the steam locomotive exclusively owns, will forever hold and which eltricity can never enter as a successful competitor.

The remaining portion of the railroad transportation field is open to the competition of the electric motor, and already the steam locomotive feels the encroachment of the electrically-driven train.

As the steam locomotive has a firm and lasting hold on both passenger and freight business in trunk-line service, so has the electric motor decisive advantages as a motive power in service requiring short trains, frequent dispatching and short hauls. This latter service embraces street car lines, elevated steam roads and, to a certain extent, steam suburban roads. No person would dispute the superior adaptability and economy of the electric motor in street-car service; nor would he think for a moment of attempting greater economy in street-car propulsion by substituting a steam locomotive for the electric motor. The street-car field belongs as undisputedly to the electric motor, or some other motive power supplied by a central power plant, as the trunk-line field belongs to the steam locomotive. Here, then, are the trunk-line and street-car fields in exclusive control of the steam locomotive and electric motor respectively, because of their special adaptation to widely different and controlling conditions which rigidly and finally prohibit competition and interchange of motive powers.

The middle, or fighting ground, therefore, lies in that field of service which embraces the elevated steam road and even the steam suburban road, where trains are short, service frequent and hauls short. The elevated-road field, which, until a few years ago, was non-competitive and in undisputed possession of the steam locomotive, has been invaded by the electric motor. A battle between these rival motive powers is now on, and has been for some time past. So far, the electric motor has achieved a decided advantage, which promises to increase as the battle goes on, should that battle not be decisively finished already.

The steam locomotive was given its place on the head end of the elevated train at a time when steam was supreme and no other real competitive power existed. The place was not won in open competition, but instead was inherited and had by right of succession. Now, the electric motor, after a hard fight and varying degrees of success, has virtually won. True, a liberal share of accidents has followed the installation of the electric motor in elevated service, but these were almost entirely accidents of conducting and transmission of the electric current rather than accidents or failures traceable to the motive power itself. The South Side Elevated road, in Chicago, has changed from steam to electricity, with advantageous results. The Brooklyn Elevated is now undergoing a similar change. The Manhattan, in New York, is at present planning to make the change. The new Boston Elevated will be electrically operated. It would appear quite evident, therefore, that the electric motor, in open competition, has established its superiority over the steam locomotive in elevated railroad service, and that the passing of the steam locomotive from this field will soon be complete.

The superior advantage of the electric motor in elevated service has been made possible by the arrangement of a motor on each truck of every car in the train, which, being operated collectively by the motorman, virtually makes driving wheels of all the wheels—or at least of one pair of wheels in each truck of the train. This arrangement is known as the 'multiple-unit control" system. In it each car is an electric locomotive, and the result is that the train is made up of such locomotives, each of which propels itself in unison with the others as well as carrying its passengers. Thus a car in this system has the carrying capacity of a passenger car and the propelling power of a locomotive.

One portion of disputed railroad territory remains to be battled for by steam and electricity. That field is the city suburban service, in which short and frequent trains are run and which has short hauls. But it will be many years before final settlement will be had, as the steam locomotive is in present possession of the field, and is doing satisfactory service. The performance of the electric motor in its newly acquired territory—the elevated service—will be closely watched by the suburban steam service, and unless the demands of that service are sufficiently exacting to call for much quicker starting out of stations and shortening of time between stops, the steam locomotive will remain possessor of the steam suburban field. However, should the traveling public expect and demand for the future a continuance of the increased passenger train speeds had in the past ten years, the multiple unit control system, with its motor on each pair of wheels, quicker acceleration and consequent shorter time between stops, will surely crowd the steam locomotive out of suburban service into long-run passenger and freight service.

Wide Fireboxes and Exhaust Nozzles Again.

Once again our friend J. Snowden Bell takes up the cudgel in defence of the so-called Wootten firebox, although he has now modified it by admitting that it is not the best, but that some form of wide firebox is essential.

When it comes to that, the main point of our difference would be in the size of grate, rather than the shape, and we have no hesitation in saying that an approximately square box has advantages in firing. It is easier to handle a fire 6 feet square than the same area in a box 10 or 11 feet long. But this would hardly satisfy Mr. Bell; 8 feet square would probably suit him better.

Returning to the question of the so-called Wootten box, it seems strange that Mr. Bell should need to be reminded of the facts of the case, for, as counsel, he must have been familiar with them.

In the haste attendant upon writing even a brief account of the work of the late Mr. Charles Graham, an error crept in which lends color to Mr. Bell's claim of originality for Mr. Wootten. As a matter of fact, the early Colburn engines had both a wide firebox and a combustion chamber, and Mr. Graham improved it by gradually cutting it down until he abandoned it entirely.

In November or December, 1854, the Lehigh No. 17 went on the Delaware, Lackawanna & Western road, with a firebox 7½ feet wide, 4½ feet long and a combustion chamber of 40 inches. After running a couple of years the box was lengthened to 6 feet. In 1855 Danforth, Cooke & Co. sent the Delaware No. 24 to the same road. This had a firebox 7 feet wide by 5 feet long and a 42-inch combustion chamber, and there were others, too numerous to mention here.

The engines "Somerset" and "Hudson," which were built by Danforth, Cooke & Co. in 1859, as well as the "Middlesex," built by the New Jersey Locomotive Works, had wide fireboxes with combustion chambers. The fact that the fireboxes overhung the frames, instead of being over the wheels, does not affect the question as to the value or priority of this type of firebox, but is merely a question of design.

If the exploitation of the so-called Wootten design "was fully warranted, both legally and morally," why did the Wharton Switch Company, owners of the Wootten patent, withdraw their lawsuit against the Rogers Locomotive Works in 1894? As those who are familiar with the case well know, this was to be a test case in order to make all the locomotive builders pay a royalty for the so-called Wootten fireboxes they had built. The fact that the suit was not brought is ample evidence that they found it was not a patent which would hold water, owing to the same device having been used years before.

Mr. Bell then attempts to discredit the comparisons of nozzles given, on the ground that the narrow fireboxes were burning soft coal and the wide ones hard coal. Allowing (for the sake of argument—though, as a matter of fact, some of the narrow ones were burning anthracite) that this is true, what of it? We were talking about nozzles and their effect on the efficiency of an engine. The fuel does not enter into this at all, for it would be very discerning steam that would detect the different coal in the firebox while it was passing out of the exhaust nozzle. Mr. Bell made a statement to the effect that wide firebox engines used larger nozzles than engines with smaller grate area, and we proved him wrong. The question of different sized nozzles for various fuels was not discussed, and has no bearing on the direct issue. The fact that engines of equal cylinder capacity used as large nozzles with narrow as with wide fireboxes proves the fallacy of his argument.

He again refers to "the ordinary soft and mushy exhaust of a wide firebox engine and the sharp bark of one with a narrow firebox," and thinks it does not take a vivid imagination to detect the difference. We fear Mr. Bell underrates his ability in this direction, and believe that as a "vivid imaginer" he deserves especial recognition.

We happen to live along the line of a railroad which uses both wide and narrow fireboxes, and both use hard coal. Now, if Mr. Bell or anyone else can pick out these engines by their exhaust, we are ready to award him a medal.

To Improve the Headlight.

In our correspondence department there is a letter on headlights which deserves the attention of headlight makers, both common and electric, and also that of master mechanics who are striving to keep headlights that throw a good light upon their locomotives. The pool system of running engine crews leads to the neglect of wiping and polishing, and the headlight reflector suffers badly for want of careful attention. The silver coating of a headlight reflector gets tarnished very readily when coal containing sulphur is used; for sulphur and silver have a strong affinity for each other, as everybody must have noticed who has carried silver money in the same pocket with sulphur matches.

The sulphuret formed from the combination of sulphur and silver is black, and ruins a headlight reflector as long as it remains in that condition. Every time that the sulphur and silver combine, a thin coating of the silver is destroyed, and it does not take very long till the whole of the silver is gone, leaving the bare copper plate. Silver is now so cheap that it would pay railroad companies to use much thicker coatings for their headlight reflectors; but the force of habit keeps most of them using a thin film that soon wears off.

Our correspondent suggests that the headlight reflector be coated with a white enamel, and we consider the idea very good indeed. A clear white enamel covering would be exceedingly durable, would be easily cleaned and would reflect light much better than a tarnished silver reflector.

His remarks about the electric headlight are also sensible and practical. There are now so many calls upon the boiler of a locomotive to furnish steam for purposes outside the power for pulling trains, that the driving of an electric dynamo may just be the last straw to break the back of this overworked camel. If a storage battery was employed which would be accumulating electric energy when daylight gave the headlight a rest, it would be likely to prevent delays through shortness of steam, and would promote the popularity of the electric headlight.

The Growing Diversity in Locomotive Designs.

A belief prevails among many otherwise well-informed locomotive officials in Europe that American locomotives are built very much in the same way that sewing machines are made, and that it is the practice of our railroad managers, when purchasing motive power, to accept the maker's standard forms. They explain that it is owing to the prevalence of this system that our locomotive builders are able to fill large orders so promptly as they do. Unfortuntaely, there is more diversity in the details of our locomotives than there is in those to be found in the British Isles, and, sad to relate, the tendency towards uniformity is diminishing instead of increasing.

For years the policy of the American Railway Master Mechanics' Association was to advocate uniformity of locomotive designs, and in some respects their labors produced good results. When the master mechanics from all over the continent first began to meet at the annual conventions of the association there was scarcely any attention devoted to keeping parts of the same class of engines interchangeable. Even screw threads were distinct individuals and each one needed the nut that belonged to it. If a machinist took off a cylinder head and failed to arrange the nuts on a string in the order they came off, he would experience grief in getting the head properly secured, especially if the work had to be done in a hurry.

One of the first things that the young association had to settle was the adoption of uniform screw threads. Looking backward upon the benefits that have accrued to railroad companies and to manufacturers from the adoption of the standard screw threads by the railroad mechanical associations (the Master Car Builders' and Master Mechanics'), it is surprising that there could have been any room for protracted discussion about the desirability of adopting the Sellers threads; but they were not made standard without a protracted fight. The standardizing of these threads by railroads did more than all other influences combined to push what are now known as the United States standard threads into general use. At that time the Government of the United States were building no steamers worth mentioning, they were doing very little manufacturing of any kind, and the engineering officials were opposed to change, as government officials generally are, and it was left to railroad companies to show by precept and example the benefits that would accrue to the country generally from the adoption of standard screw threads. The railroad men proved to be good missionaries. They were able to show convincing object lessons after the standard threads began to be freely used in car construction. A car from Minnesota would reach New Orleans with sundry nuts missing from the truck bolts. The car repairer, instead of driving out the bolts and proceeding to fit nuts to them, merely measured the bolts and took out of his box nuts that fitted without difficulty. That was a great revelation to the machinists or blacksmiths that happened to see or hear of the operation.

The opposition which was raised at first in the associations to the adoption of standard screw threads, and the discussions that ensued, had an excellent educational effect. It brought out information about the advantages of using interchangeable parts, and many railroad mechanical officials learned for the first time that springs, equalizers, axle boxes, pumps and other parts of locomotives could be made interchangeable without much difficulty, and that the arrangement shortened the time needed for repairs and enabled a railroad company to greatly decrease the stock necessary for repairs. We believe that Mr. James M. Boon, then master mechanic of the Chicago, Pittsburgh & Fort Wayne, was the pioneer in this work, but his example was soon followed by others.

The proselytizing in favor of uniformity of car and locomotive parts logically led to the car and the locomotive as a whole being made standard. After the screw-thread standard was settled, the Master Car Builders made a brave effort to have a standard freight car body adopted, and the struggle in that direction was carried on for years; but no agreement could be reached, which, in the light of the progress made since those days, was really fortunate. Many of the master mechanics were in favor of the adoption of a standard locomotive that the builders could keep in stock and work on in dull times; but that, like the standard car, was never realized. But the agitation in that direction had a good effect. It influenced the master mechanics to adhere as closely as possible to established forms. It became the practice of railroads to make the engines of a certain maker their standard, and the parts of new locomotives purchased were interchangeable with those already on the road. To such an extent was this carried that the entire drawing office force of an establishment building 250 locomotives a year was at one time an architect and a boy. The railroad systems were extending rapidly and the companies that had not adopted locomotives of a particular make were contented to accept what they could get, especially if the delivery was prompt.

Towards 1890 tnis condition of affairs began to change. The leading railroad systems were nearly full grown, and the men at the head of the mechanical departments began to consider the type of locomotive best adapted to the physical conditions of the system and the traffic to be hauled. The problem of moving trains at the least possible cost was persistently pushed upon the locomotive department for solution, and those responsible could no longer adhere to the standard form of locomotive that had done the work satisfactorily while the road was growing. To satisfy the new requirements locomotives must be designed and built of much greater power than hitherto had been considered necessary, and much consideration has been given to forms, appliances and dimensions that are likely to enable a pound of coal to perform more work than it had ever done in the fireboxes of the pioneer engines. The common-sense ingenuity and inventive ability of our mechanical engineers are still busy working on the problem of the best forms of locomotive to perform the company's work. There will be many blunders made, as there always are during a transition period, but the fittest forms will be produced in the end. We need never hope, however, to see anything approaching uniformity of designs again.

The Indicator.

At the last meeting of the Traveling Engineers' Association, at Cleveland, a report of which was in the October issue, the indicator question was taken up and thoroughly discussed. The committee's report was very full and specific, both as to the method of doing the work and the advantages derived from a knowledge of the steam distribution.

It has been repeatedly stated in these columns that the indicator has not had a fair chance to show its real value in locomotive work. It has not been used to locate defects in the engines in service and enable the shop force to correct these defects; but in a fair number of cases, it is used to show up the good points of some new design of valve motion or new way of setting the valves; these new methods run their brief course and drop out of sight, leaving the ordinary link motion still in the field and doing all the business in its own way. We should be able to help it do its work better if possible.

This report shows the way by which the traveling engineer can locate some of the troubles when an engine is not doing all the work that the steam is able to perform.

Some very plain facts are stated as to possible defects which can be located, and these facts are stated in a plain way. The various styles of indicators are illustrated, as well as reducing gears and the calculating machine (planimeter) for showing the exact size of the card after it is taken.

While these descriptions and prices, which very likely are taken from the manufacturers' catalogue, may look like advertisements, yet the officer can have everything at hand in one report to give him an idea of the cost of these appliances.

To popularize the use of the indicator among the men who operate locomotives it is necessary that they be made familiar with its operation through actual experience. They should have a chance to study the records which the instruments have made. If an engine is taken out of service to attach the indicator and then sent out on some particular train, which may be most convenient to try the indicator on, the man who loses a trip and never sees or hears anything of the cards is liable to think the whole business of little value to him. But if the cards are shown around, the various points explained so the engineer can see where this information is useful, he will appreciate it.

Pick out the engine that does the poorest work for the amount of money it costs to run her and try the machine on her, then when the trouble is located make some changes which will improve her work. If you cannot show good results the indicator will be a failure in the opinion of all. Use it to make a poor engine better instead of trying to show off the good ones. Stick close to practical lines and do not attempt to show too many things at once. Make one change at a time and try for another card, for it is certain that one change in the steam distribution will also change some of the other conditions.

We hope that the officers in the operating departments will give needed encouragement to their traveling engineers to follow up this matter and give it a practical trial. It can be made the means of increasing the earning power of the engines without any increased cost of maintenance by showing how the poor-working engines can be made better, possibly in some cases as fast and powerful as the best ones in their special class.

A New Form of Compound Locomotive.

There are a great many types of compound locomotives now in use, and there is considerable diversity in the cylinder arrangements and in minor details, but they all adhere with little difference to a common principle of design regarding the ratio of the high to the low-pressure cylinders. When the first compound locomotives were introduced, the designers, by a sort of fortuitous guesswork, made the ratio of the high-pressure to the low-pressure cylinders about as 1 : 2. At first this ratio was adhered to for all types of compound locomotives, two-cylinder, three-cylinder and four-cylinder engines. Later on, some of the designers increased the low cylinder ratio, but there never was any tendency to decrease it until recently, when Mr. John Rickie, locomotive superintendent of the Indian State Railways, made a bold experiment in compounding locomotives, in which he uses a cylinder ratio of 1 : 1.25. Mr. Rickie has been an occasional contributor to LOCOMOTIVE ENGINEERING, and our readers who have carefully read his communications will agree that his ideas combine originality, practicability and lucidity—a somewhat unusual combination. We consider his latest feat in locomotive designing displays all these characteristics.

In an article contributed to the London *Engineer*, describing the engines of his novel design, Mr. Rickie tells that two of them are at work on the Indian State Railways, with gratifying results. The system consists in using two outside cylinders of about the same size as if the engine were simple and a single inside cylinder, the whole of the power-transmitting mechanism being connected with a cranked driving axle, the cranks being set at 120 degrees. Two pairs of driving axles are coupled to side rods in the usual way. The peculiar difference between this and all other three-cylinder compounds is that steam is always cut off short in the high-pressure cylinders, while the low-pressure cylinder does not cut off till about 80 per cent. of the stroke. By a special arrangement, the steam ports of the low-pressure cylinder are fully opened early in the stroke at all speeds while the cut-off is constant. Indicator diagrams taken from the engines show that an excellent distribution of the steam is secured. The values of the high-pressure cylinders can be regulated to cut off at any point of the stroke within the range of a link motion; but as soon as the steam begins to enter the low-pressure cylinder, the practice is to link up the high-pressure cylinders to cut off at about 20 per cent. of the stroke. Unless this is done, the engine will have too much tractive power and wheel-slipping will begin.

In describing his system Mr. Rickie says it was, "to show how it was practicable to improve on the present system by combining the advantages of the simple engine, which has great power at starting, with that of the compound one, which has a wider range of expansion, but which is less powerful, and so enable the combination to exert greater power than the simple engine, and at the same time offer a wider range of expansion than can be had with existing compound engines. It is from this latter improvement that greater gain is expected. No matter what may be said regarding the power of compound engines on the level, grade climbing proves that the latter cannot haul an equal load with the former, for the obvious reason it cannot make use of an equal volume of steam as at present designed, no matter how big the boilers may be. Is it not just possible, then, that too much stress has all along been, and, in fact, still is laid on the amount of loss that takes place due to change of temperature in the walls of cylinders? Loss there unquestionably is. But does the increase in range of expansion as applied to a simple engine not more than compensate for any loss? To my way of thinking, there can only be one answer, otherwise the gap in economy between the simple and compound engine would have got wider and wider with each successive rise in boiler pressure, until the simple engine would have ceased to be made. In place of which, a number of railways will not even try a compound locomotive, and little wonder, for even the advocates of compounding admit that such engines are not adapted for working trains with short runs on account of the frequent stopping and starting. Now, with a slight increase in boiler pressure, the simple engine can be made to work compound by the addition of one cylinder, enhancing the power by 30 per cent. As the reversing lever is placed to a 20 per cent. cut-off immediately on starting, not only is the engine more powerful than it originally was, but it is at the same time more economical than the existing compound engine, eminently fitting it not only for short runs, but for grade climbing, or, indeed any purpose."

In India, as in every other country, the man who runs a locomotive has a great deal to do in making a success or a failure of any innovation made on existing forms. These engines are so arranged that every convenience is provided for the enginemen. In the first one an automatic arrangement was put on to have the high cylinder valves cut off at 20 per cent. as soon as steam reached the low pressure piston. That was dispensed with in the next engine, as it was found that the drivers were ready enough to shorten the cut-off as soon as the engine got going. Mr. Rickie says: "The drivers are charmed with the ease with which the work is done, and can scarcely conceive that they are not working a simple engine; indeed they treat and handle it in every way similar to a simple one."

In addition to the great power and economy in steam consumption that is brought about by the adoption of this system, the designer believes there is still another important one, which is the remarkable reduction of wear and tear to boiler and machinery. When the engine is working up to its highest power the boiler is not required to generate nearly so much steam as it would have to do for a simple engine. This avoids the great forcing of the fire and thereby saves damage to firebox and tubes. The cranks being set at evenly divided points in the revolution, the turning effort is more uniform than it can be with cranks set at 90 degrees, the revolving parts are better balanced so that the wear to driving wheel tires, driving boxes and other working parts must be reduced.

We think that Mr. Rickie has made out a good cause for his engine, and hope to see it given a fair trial on European and American railways.

Members of the Angus Sinclair Company have purchased the *Automobile Magazine*, which has been in existence about a year and has attained considerable popularity. The new proprietors are bending all their energies to the improving of the magazine and to increasing its circulation. The purpose is to make the *Automobile Magazine* indispensable to the owners of motor carriages and to the publishing of articles that will be interesting and instructive to the people handling automobiles. The magazine will be published in the office of LOCOMOTIVE ENGINEERING, 95 Liberty street, New York. The yearly subscription price is $3; single copies 25 cents.

For several years past the traveler to New York has observed the excellent cab service of the New York Central at the Grand Central station, and the Pennsylvania Railroad at the Twenty-third street ferry. The latest departure of this kind, however, is the automobile service which the Baltimore & Ohio Railroad has established to and from all "Royal Blue Line" trains at its Liberty Street ferry, New York city.

The Annihilation of Space, or High Speed Railroading.

In the October issue of the *Munsey Magazine,* which, by the way, Mr. Munsey says on the front cover he regards as his ideal of a modern magazine, Mr. Munsey tells us all about high-speed railroading, under the title of "The Annihilation of Space." He seems to have become convinced that all that hinders high speed to-day is the method of using two rails, and that the adoption of a single-rail system gives us the key to the whole business.

He shows the plans of the three B's—Boynton, Brott and Beecher—and proves to his own satisfaction that the one-rail system, with guide wheels under each side to prevent leaving the track, is all that is needed to secure high speed.

Nothing is said about engines or motors, as they don't seem to count if the rail is right—so the car can't jump the track. Two hundred miles an hour is to be secured, and Philadelphia, Baltimore, Washington, Pittsburgh, Boston and Buffalo are to be suburbs of New York, Chicago five and San Francisco fifteen hours away.

Practical railway men know that the question of the train leaving the track is a small one on straight track, and that curves can be made to suit any speed. Why should a train leave the rail on straight track any quicker at 100 miles an hour than at 50? It weighs the same in either case, and gravity doesn't forget its little duty because the train happens to be humping itself.

The real questions to be dealt with are power, cost of operation, keeping a clear track for fast trains, and cool journals. The inventors of single-rail or other railroads rarely consider such little details as switches, right of way, or that freight traffic makes up the bulk of a road's business. The four-track roads keep practically clear tracks for passenger trains, but locals must be considered and kept out of the way of through trains, and numerous other details.

Many roads to-day make miles in 45 to 50 seconds and think nothing of it; but when it comes to maintaining this speed it's another matter, and until travelers are willing to pay a greatly advanced rate of fare, it is safe to say that railway speed will not reach 200 miles an hour. Not that we have reached the limit of speed, for that will probably increase slowly; but there are many other points to consider besides the rails or roadbed.

Demand for Steel Cars.

At a banquet in Pittsburgh Mr. J. K. Cowan, president of the Baltimore & Ohio, said: "I have just concluded a contract with Mr. C. T. Schoen, president of the Pressed Steel Car Company, for 6,000 steel cars, involving the use of steel plate equivalent to that which would be required to build ten of the largest steel freight ships afloat. Four thousand of these cars will be distributed in the Pittsburgh district."

Mr. C. T. Schoen said: "The order is undoubtedly the largest ever given, and I would state that the Pressed Steel Car Company in the last eight days have taken contracts for steel cars approximating in money value nearly $7,000,000. The amount of steel needed to complete the order will amount to about 100,000 tons. And the most gratifying thing about all this is that it betokens greater things in the future; because, while our business is at present enormous, yet it may be said to be only fairly started into a healthy growth to a normal sturdy stature, as is amply evidenced by the fact that once a road buys the steel cars, orders are duplicated, triplicated and quadrupled."

Besides the order mentioned, the Pressed Steel Car Company have lately closed with the Union Pacific for 480 steel ballast cars of 110,000 pounds capacity and 300 coal cars of 100,000 pounds capacity, as well as 300 steel cars for the Transvaal, South Africa, and an order of seventy-five steel cars for the Davenport & Rock Island Railway. These orders combine to make the largest single week's business ever done by any one concern in car-erecting circles.

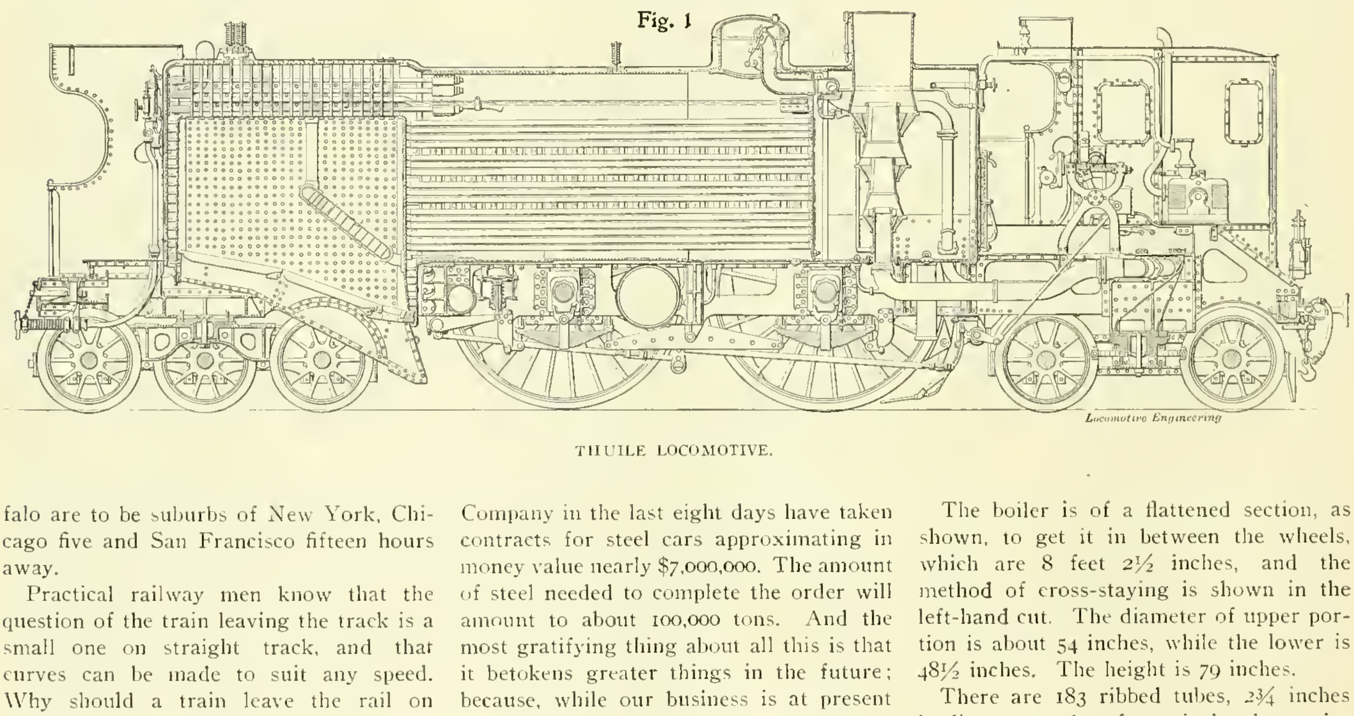
A French Design for High-Speed Locomotives.

This is what is known as the Thuile system of high-speed locomotive, and is exhibited at Paris by Messrs. Schneider & Co., of Creusot. It was designed to haul trains of 180 to 200 tons, or, say, four Pullmans, at 75 miles an hour on level roads, and is calculated to develop 1,800 to 2,000 horse-power.

There are four coupled wheels, a full truck in front and a six-wheel truck under the back end, although the necessity for this is not apparent, as there are only 29½ tons, or 59,000 pounds, on this truck. This makes less than 10,000 pounds on a wheel for this truck and under 15,000 for a four-wheel truck, which would seem preferable to the extra pair of wheels.

The driving wheels carry only 65,000 pounds, or about 16,000 pounds on a wheel—but little more than is carried by the trailing truck. The total weight of the engine in working order is about 165,000 pounds, and the tractive power 15,652 pounds.

Fig. 1



THUILE LOCOMOTIVE.

The boiler is of a flattened section, as shown, to get it in between the wheels, which are 8 feet 2½ inches, and the method of cross-staying is shown in the left-hand cut. The diameter of upper portion is about 54 inches, while the lower is 48½ inches. The height is 79 inches.

There are 183 ribbed tubes, 2¾ inches in diameter and 14 feet 3 inches long, giving a heating surface of 2,941 square feet, which with 263 feet in firebox gives a total of 3,204 square feet. The boiler pressure is 213 pounds. The grate area is very large for European practice, being a trifle over 50 square feet.

Cylinders are 20 x 27½ inches, and a Walschaert valve gear is used. The total wheel-base is 40 feet 2 inches, and entire length of engine 46 feet. The cab, which has a wind-splitting attachment, is in front of the engine, while the fireman is at the rear—46 feet away.

The tender is also of peculiar design, having ten 42-inch wheels under it, as shown. The wheel-base is 25 feet 7 inches, and the tender weighs about 49,000 pounds empty, and 121,000 in working order. It carries about 6,000 gallons of water and 7 tons of coal. We are indebted to *Engineering*, of London, for the data given.

The engine shows traces of very careful designing and the construction work has been wonderfully well done. We listened to several well-known European engineers discussing the merits and shortcomings of the engine, and we were surprised to find that the consensus of that opinion was favorable. The writer dislikes to be in the minority, but he has enjoyed many opportunities of passing judgment on so-called original types of locomotives that were going to push the common types out of service. He never made a mistake of judgment in telling that the ordinary original type of locomotive was a fake. He has now no hesitation in saying that the Thuile locomotive will fall into rank with the Fontaine, the Raub Central Power, the James Toleman and the Holman locomotives, all of amusing memory.

Furnace Gases.

At the October meeting of the Western Railway Club, a paper on "Observations on Smokeless Gases in Fireboxes" was presented by A. Bement, which gave a view of this question from the chemical analysis side. Mr. Bement made careful analysis of the gases escaping from the fire, to ascertain the exact amount of carbon dioxide contained. This carbon dioxide being the combination of carbon in the coal and oxygen of the air which makes heat, would therefore show the proportionate amount of heat produced by the fire, a high proportion showing good combustion; a low proportion showing poor results.

In the practical application of this method, it was stated that to the two generally recognized important factors in smokeless combustion, viz.: high firebox temperature and liberal air supply, he would add a third, a proper mixture of the air and gases, arranging them in their order of importance, as, first, high temperature; second, what may be termed mixture, and third, air supply.

He considered the brick arch the most important instrument in promoting the mixture of the gases and air. The arch is an obstacle in the path of the gases, changing their direction and promoting a more thorough intermingling, with the effect of causing the contact of carbon and oxygen, and when this is secured (at the high temperature near the arch) the combination is instantaneous.

The steam jet promotes mixture by stirring up and beating together the gases, but is not equal to the brick arch. It has the effect of reducing the temperature, owing to the high heat capacity of the steam. When the use of steam jets is accompanied by the reduction of smoke, it is because carbon has been brought in contact with oxygen, and for no other reason.

While it is difficult to arrive at definite conclusions as to the heat loss when the jet is used, combustion is promoted to an extent that makes up the loss, leaving the reduced amount of smoke as a gain.

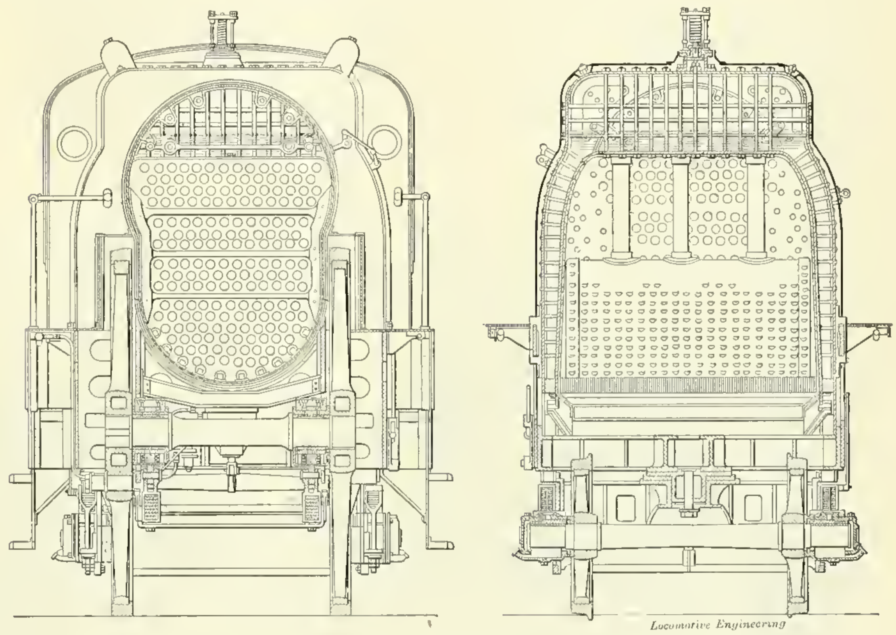
Mr. Bement stated, in presenting this paper, that the judgment shown by the fireman in carrying on the various operations of supplying coal to the fire, regulating the air supply both above and below the grates, was of the first and greatest importance.

In the discussion that followed, a member stated that the proper mixture of the gases with the air was very important, citing the efficiency of water-tube boilers as a point; the gases in passing around and through between the tubes were thoroughly mixed.

Mr. G. R. Henderson, of the Chicago & North Western Railway, stated they found the steam jet was a diluter as well as a mixer of the gases. Fireboxes with two separate firedoors gave better results than with one, as each side could be fired alternately.

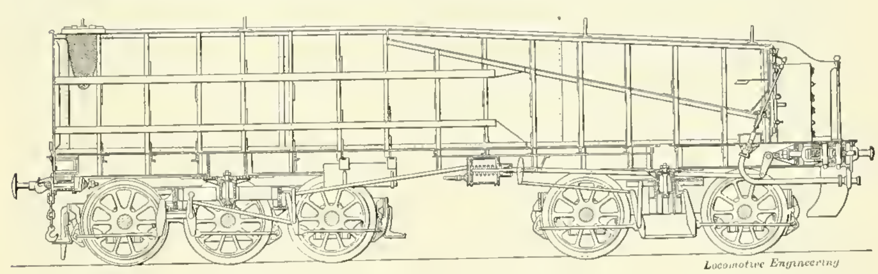
Mr. Delano, Chicago, Burlington & Quincy Railroad, stated that they had tried the hollow brick arch, which is so arranged that a supply of air passes through the center of the arch and comes into the firebox above the grates. This arrangement is intended to heat the air up to the igniting point. It had not proved a success, and better results in smokeless firing were obtained when the air inlets were closed up. He spoke of the successful operation of long flues, having some in use 16 feet long. These he thought were economical, although the general opinion was that that was too long for good results.

Mr. Webb, traveling engineer on the Michigan Central Railroad, said that a good steaming engine, a good fireman and a careful engineer who would make the best use of all the advantages, made the best combination to ensure smokeless firing on a locomotive.



SECTION OF BOILER. SECTION OF FIREBOX.

THUILE LOCOMOTIVE.



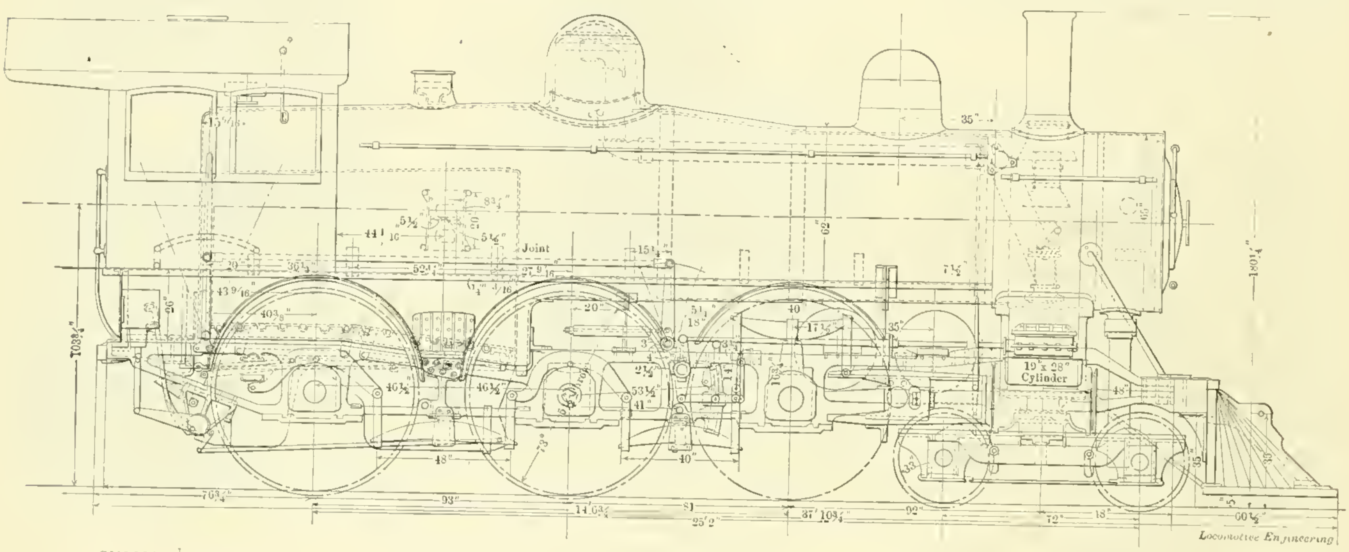
TENDER OF THUILE LOCOMOTIVE.

Master Mechanic McBain, of the same railroad, added that the proper arrangement of the front end to suit the kind of coal burned, was very important. What would suit one kind of coal would sometimes give poor results when another kind of coal was used.

Mr. Conger, of Locomotive Engineering, called attention to the Bates firebox door, similar to the one used on the Southern Pacific Railroad. This door, which is about 5 x 16-inch opening, is not closed at all between shovels of coal, and gives very good results on all kinds of engines, both for economy of fuel and smokeless combustion.

Convention Favors Pintsch Light.

At the national convention of Railroad Commissioners held at Milwaukee some very interesting reports from the various committees that had been appointed the year previous were presented and adopted. Among them were papers on "Classification and Construction Expenses of Steam Railroads," "Delays Attendant upon Enforcing Orders of Railroad Commissioners," "Legislation," "Uniform Classification" and a very important report on "Safety Appliances." In this last paper some excellent recommendations were made which were adopted by the convention. The question of car lighting was cared for by a report as follows: "The Pintsch gas-light system is another improvement rapidly coming into general use. Its great advantages are most highly appreciated by the public, and its adoption, wherever practicable, should be required."



SYMONS' TEN-WHEEL PASSENGER ENGINE—BUILT BY RHODE ISLAND LOCOMOTIVE WORKS. DESCRIPTION ON PAGE 465.

Proposed Schools for Trackmen.

Mr. Walter G. Berg takes a great deal of interest in the education of railway men. At an association meeting, he recently submitted a paper on the education of railroad men for the subordinate ranks of the maintenance of way service, in which he advocated the establishment of a special railroad trade school, to be devoted to the teaching of practical railroad track work, the entrance requirements of which would be limited to a general common-school education. The school should consist of a regular course of one year, and of an advanced course of one year, in addition to a general course. The pupils for the regular course would be boys direct from public school and young men who, after a few years' work in a shop, office, store, or railroad department, began to realize that their rapid success in life might depend largely on a better general knowledge of and familiarity with one subject or some specialty.

The efforts of Mr. Berg in this matter are very highly commendable, but we are afraid he is not likely to find many young men ready to enter a school that will give them education to fill subordinate ranks and maintenance of way service. The work in that department is too toilsome and too poorly remunerated for ambitious young men of intelligence to enter with the expectation of making it their life work.

The Unexpected Which Often Happens.

Professor John E. Sweet, of Syracuse, inventor of the straight-line engine, is one of the best informed mechanical engineers in the world, and he never writes or speaks on any subject without giving original information well worth preserving. Our note books are full of cuttings giving Professor Sweet's ideas of things mechanical. We select one sheet from an address on the "Unexpected Which Often Happens":

"If we had no experience or knowledge, or no knowledge of the experience of others, everything which happens would be unexpected. It is not so much the unexplainable as the unexpected which attracts our attention, excites our astonishment or disturbs our mental equilibrium. The man who devotes his life to experimenting with practical mechanics is sure to meet with the unexpected, or else to be too wise for his generation. Some of us do not care to admit that we were ever caught with the unexpected, but I beg to expose a few of the many things that have come upon me unexpectedly, in the belief that they may be of use to others, and in the hope that others will explain their experiences, so that we may profit in return.

"Things perfectly familiar to mechanics engaged in one branch of industry are often matters of great wonder to workers in another branch. Men may work a lifetime in cast iron as applied to tools and machinery, and yet know nothing of what it will do in the heating stove of a blast furnace. To such a man the discovery that cast-iron heating pipes grow from 6 inches to 1 foot in length by use would be unexpected. To tell the blast-furnace man that certain core bars, used for casting pipes, changed their length by 3 inches in casting twenty or thirty pieces would be no surprise, until you supplemented the statement with the fact, strange to him, that they grew shorter, rather than longer.

"The unexpected sometimes comes from causes that are perfectly self-evident after the thing has happened (as was the case in my experience by the clogging of a nail machine by the scale from the nail plate), and at other times from causes utterly unexplainable, or from causes which are difficult to fathom. In practice we use with a fair degree of success for a piston-rod packing simply an easy-fitting Babbitt bushing. When these bushes become worn so as to leak, we close them up by compressing them in the water cylinder of a sort of hydraulic press. In this operation a mandrel somewhat smaller than the piston rod is put inside, and with all the pressure we can bring to bear we have never been able to compress the bush so as to make it grasp the mandrel tightly; and yet in two or three cases, or perhaps in half a dozen, we have had these bushes (one of them after running a year) shut down while the engine was running, so as to grasp the piston rod as if it were gripped in a vise—in fact, so strongly as to break the bushes asunder, or so that we had to destroy them to get them off.

"The unexpected comes upon us both by things not working when we think they ought, and by their working when common reasoning would indicate that they ought not. The man who first invented or constructed a lawn mower must have been considered an idiot, or at least not a man familiar with the common laws of mechanics, to have imagined that he could, with two light wheels, get traction enough to rotate a cylinder of six times their own weight, at six times their own velocity, and cut the grass in addition. The worm that drives the bed of a Sellers planer does not wear out half as fast as it ought, and

I fancy there is something unexpected about it, even to the makers themselves.

"An engine with a 12 x 18-inch cylinder had been running a year at 185 revolutions a minute, standing quietly on a cut-stone foundation. One day, without any apparent cause, it began to shake endwise, and before night had shaken itself loose so that it had a movement of 3-16 inch at every turn. The engine, being self-contained, no harm came to it, except the loosing of the foundation, and as the work was of more consequence than the foundation, it was allowed to go on, with a view to repairing it at vacation time, a month ahead. But before vacation time came the shaking stopped without any more apparent cause for its stopping than for its beginning, and the engine continues to run quietly to this day, notwithstanding the shattered foundation.

"The unexpected often happens to the scientist as well as to the practical man, and this must have been the case with Crookes when he invented the radiometer. The story goes that he first invented one thing, and then made it; but it turned out as tradition says the ship did, when some genius blew into the sails with a bellows. It went the wrong way. We laugh at the stupidity of the man with the bellows, and the next generation may laugh at Crookes.

"An engineer put in charge of our electric light station found them using oil of 26 gravity for lubricating the engines and dynamos. Even when the oil was used freely the bearings would warm up, and sometimes get hot. It was the practice to increase the quantity of oil as the journals got warmer and to turn on water when oil would do no longer. To the engineer's surprise he discovered one night that one of the bearings kept cool, and he noticed also that the oil cup was feeding only about one-quarter as fast as had been the practice. The happy idea of letting well enough alone occurred to him, and he found that the bearing continued to run cool; and by experimenting he proved that by feeding little enough oil he could make the other bearings run cool also.

"For casting a chilled die, to be used under a drop hammer, old chilled car wheels were used, to which 14 per cent. of spiegelsen was added with the expectation that a good chill would be produced, as this had been our previous experience. The first surprise was to find that the die showed no evidence of chill whatever, but that it could be filed easily. Some pieces of work were required at once, and the die was put in, with the expectation that it would serve only for a short time, but the second surprise came when its endurance proved to exceed the best of the chill d dies in the proportion of two to one.

"A large percentage of the unexpected comes in the development of original inventions. When these are in the experimental stage it is easy to brand the inventors fools or lunatics; but when predicted failures succeed it is easy also to forget that we ever expected anything else. It is not always the ignorant who are wrong, or the best informed who are never in error. If ten [now twenty] years ago the possibility of conversing with people fifty miles away had been publicly suggested, it would have been accepted only by the ignorant, who, remembering the marvels that have been accomplished, would, in their blind faith, admit of its possibility, while the best informed would have been staggered at the thought. Less than ten [twenty] years have now rolled away, and it is an everyday occurrence.

"It is not always the uneducated, the insane or the stupid who produce failures, nor the best educated, most thoughtful or most experienced who bring out everything according to the original intention. The unexpected comes to the good and bad alike, and so, in our teachings to the young and our planning for ourselves, is it not well to have our statements and our speculations pretty well saturated with the elements of uncertainty?

"It is an old and common custom to use the statement that 'two and two are four' as an example of the certainty of certainties, and another, that 'like causes produce like effects'; while, as a simple matter of statement, the first can easily be shown to be 25 per cent. off, and the latter to hold along all the way from like results to results diametrically opposite."

Views from Nijni Novgorod.

We reproduce a few views from the town of Nijni Novgorod, Russia, to give an idea of the life there, and one from the boiler shop of the locomotive department of the Sormovo Works to show some of the customs existing there.

The titles make little explanation necessary. The Sunday morning fair or sale affords an opportunity for the devotees to supply themselves with the necessary pictures and objects of worship which are used by the Greek church. The workman's house looks fairly comfortable.

The town well, or one of them, has a place of honor in the main streets and supplies the houses on the street. The club-house was a Chinese pagoda at one of the large fairs in Nijni Novgorod, and was bought by the officers of the Sormovo company for a club-house.

Every shop building of the works has to have its holy picture and lamp. This is in front of the painting over the man's head, but can hardly be distinguished, owing to the reflection. They are fine paintings, and the lamps are also said to

TOWN WELL.

CLUB HOUSE OF SORMOVO COMPANY.

NIJNI NOVGOROD.

be works of art. As each workman passes the picture, he makes the proper observance, and at regular intervals services are held by the resident priests.

It seems odd to an American to think of religious services in a boiler shop, but it's all owing to custom, we suppose.

Smoke in British Cities.

The British Association is an organization formed in Great Britain for engaging in scientific research, and it includes many of the most celebrated men belonging to the world of science. Meetings are held annually and papers are read that give facts relating to discoveries made by the members. The annual convention was held this year at Bradford, a large manufacturing city in the midst of a great manufacturing center. Wherever a forest of tall chimneys marks a landscape there are blackened buildings and stunted vegetation, and the community is interested in anything likely to abate the nuisance. The smoke from English coal has a peculiarly blackening effect. The buildings in Manchester and Sheffield are much worse blackened with smoke than those of Pittsburgh, although the volume of smoke emitted must be very much less.

The question of smoke-prevention being always present with the British people, much interest was manifested in a paper read at the British Association meeting by Dr. J. B. Cohen on "Smoke Prevention." Dr. Cohen lives in Leeds, a large manufacturing city, and has examples of the injury done by smoke constantly before his eyes. Smoking chimneys are evidences of prosperity, but steam may be made to turn the wheels of industry without the waste of energy represented by huge volumes of smoke passing out of smokestacks all the time that work is going on. When it is practicable, the people living in and about manufacturing towns ought to be permitted to breathe air untainted by the fumes that pass from coal that has undergone imperfect combustion. There is a theory held by people who apologize for the smoke-raisers, that sulphur dioxide has antiseptic properties; which may be true, but the same compound is more likely to become, by an easy natural transition, sulphuric acid, which corrodes everything it touches. The fact is, as we have frequently pointed out, that the smoke-polluting in all large manufacturing cities represents unused energy escaping in a very disagreeable and destructive form.

The author of the paper referred to, who is a professor in a scientific school and has made combustion of coal a special study, made the assertion that the amount of soot given off from factory chimneys was from one-half to three-fourths of 1 per cent. of the coal, and that with domestic fireplaces the soot was about 5 per cent. of the coal. This is, in its way, serious enough; but the lecturer put the question in a concrete and readily understandable form. He said that in the Leeds smoke-infected area, which measured four square miles, he estimated that there was a minimum loss of fuel in the form of soot to the value of £300 per year. Now, one of the chief drawbacks to the prevention of black smoke is the impression on the part of workshop and factory owners that some needless attempt is being made to restrict their liberty or place an undue burden upon their shoulders, sufficiently weighted already. Once they realize that smoke is an extravagance, a waste of good material, there will be an end to the present state of affairs. Consequently, we cannot be too thankful to men like Dr. Cohen for their scientific exposition of a subject that is hedged round with prejudices and preconceived notions.

As Professor Smithells, of the Yorkshire College, said, it has now been satisfactorily demonstrated that fuel could be burned for pretty nearly every manufacturing purpose without the production of smoke—and that without any undue expense. What was now required was that public opinion should be aroused upon the subject. At present, he added, people were apathetic, and did not realize the magnitude of the evil—a fact of which the government and local authorities were well aware. Probably nothing would be done until the evil attained such a pitch as to cause a public revolution of the kind that was caused with regard to river pollution. The apathy of the public is purely due to the impression that too much pressure on this matter might lead to the unnecessary harassment of industries. Once it is proved that no consideration of the kind is involved—that, in short, it is to the manufacturers' own advantage not to have smoke—there will be a speedy and wholesome revolution in public sentiment.

We have returned to this subject because we consider it one needing constant missionary effort. To show the transgressors that they are wasting their own substance unnecessarily ought to bring about reform. All that has been said about smoke in British cities applies to all the manufacturing cities in America.

STREET FAIR—SUNDAY MORNING.

WORKMAN'S HOME.

NIJNI NOVGOROD.

Cooling Water in Nicaragua.

A railroad man just returned from Central America, and describing some of the customs of the people of that tropical climate, talks interestingly as follows: "These natives have a peculiar and primitive method of cooling water for drinking purposes. The principle is easy and simple, but there is a knack about it that I have never yet known a white man to fully acquire. I have never made a test with a thermometer, but I can assure you that with this method they can reduce the temperature of tepid water to that of a very cool mountain spring.

"When a native in one of the broiling-hot little villages of Nicaragua wants to cool some water, she fills a half-gallon earthenware jar about two-thirds full. I say 'she,' because this is a task that requires more energy than any male Nicaraguan was ever known to possess. The jar is made of baked clay, and, not being glazed, is partially porous and soon becomes moist on the outside. Two leather straps are firmly attached to the neck, and, seizing these in her hands, she begins to rotate the jar swiftly in the air. The mouth of the jar is wide open, but the centrifugal action keeps the water from spilling out.

"The average native woman is frail and listless in appearance, but the endurance she exhibits at this sort of calisthenics is marvelous. It is about the same as swinging Indian clubs, and I am afraid to say how long I have seen her keep up the rotation, lest I be set down as a prize liar. Generally, the lord and master reclines in one corner of their rude hut, smoking a cigarette and watching the process languidly. When the woman thinks the water is sufficiently cool, she stops with a dextrous twist of the wrist and hands him the jar. Usually he takes a gulp and growls out: 'Moocha calora!' which, in the native lingo, means 'darned hot,' whereupon the woman again seizes the jug and patiently describes pin wheels until the water is cool enough to suit the brute of a husband."

Ancient Labor Organizations.

Many people believe that labor organizations are an outcome of modern social and political conditions, but that is far from being the case. Highly organized labor brotherhoods have exercised powerful influence in China for thousands of years. A revolution which brought the present evil dynasty into power was greatly aided to success by labor brotherhoods which were discontented with treatment received by the old dynasty, and the Boxers are a sort of political-labor brotherhood.

A writer in the *Conductors' Magazine* gives the following particulars about ancient labor organizations:

"Labor organizations can be traced back as far as the time of Moses, and their members, though slave, dared quarrel with the Pharaohs for better food and treatment. The Greek-speaking people had the right of free combination to at least nine trades. In those simpler times the nine occupations were the industries of agriculture, mechanics, the shipping and boating business, even the corsal traffic, music, fortune-telling, sorcery, astrology, the races and the theater. It was a vast union or federation of brotherhoods. Paul the apostle told the brethren to stand steadfast as a universal brotherhood. Truthfulness and goodness were requisites of membership. The feature distinguishing these organizations is that they were almost purely economical. Their uppermost question was the problem of existence, and this is the great subject before the brotherhoods of to-day.

"A similar right was given to the laboring people of Italy to an almost unlimited organization by Numa Pompilius, the king of Rome. It applied to the musicians, goldsmiths, masons, dyers, shoemakers, tanners, braziers and potters. Under this law the right of trade unionism became sacred to mechanics and laborers.

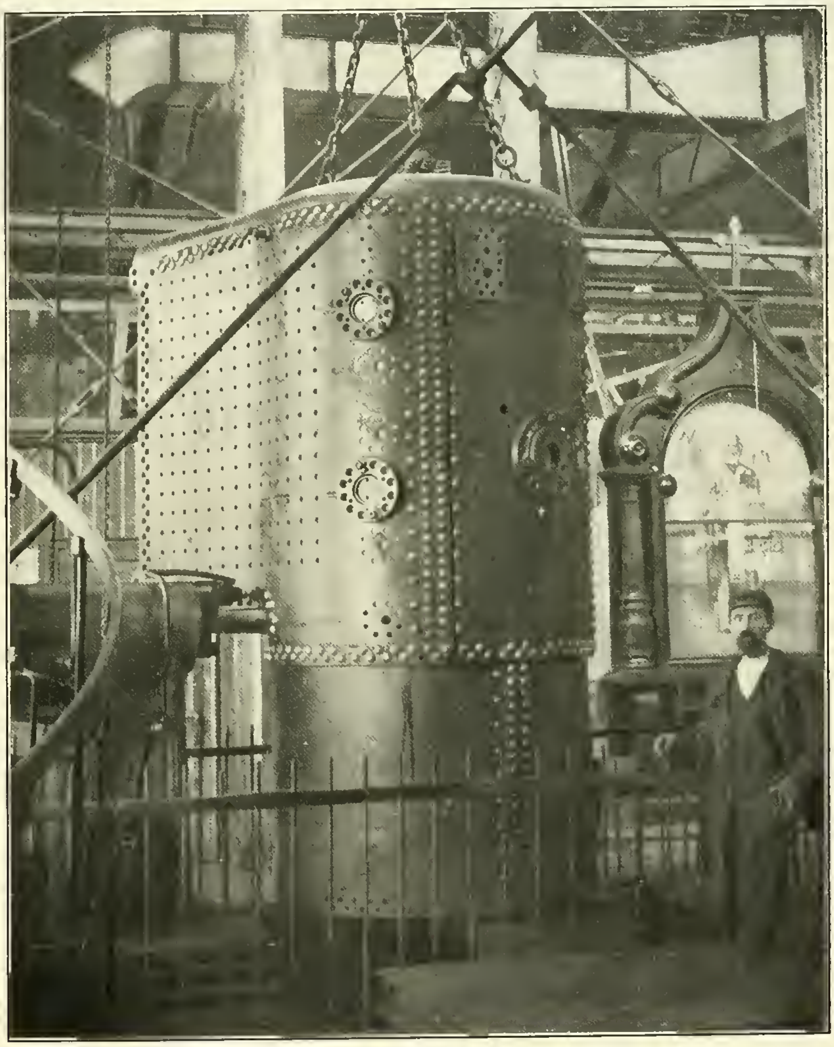
"After the great conquests, when all nationalities became subject to Rome, it was practically one law, and to some extent one organization. It is supposed by some of the archæologists that these unions were guilds. About 450 B. C. this bread-winning class was attacked by one Appius. The organization suffered, but it could not be destroyed. It actually grew, outliving the oppressions of the Cæsars and was strong until suppressed by the council of Laodicea, maintaining itself against opposition for fully a thousand years. During the greater part of this time its tenacity of life brought it through many a dark vicissitude, while being fought by the lords because its political growth was feared and hated, as it is this day. The conclusion arrived at is, that the organization of labor to-day is largely due to these ancient brotherhoods, and it lives because it was nourished in secrecy by them until it could stand alone."

Some of the early track (or plate) layers would open their eyes in order to see the maze of tracks that is to be found in any large terminal.

Train Lost its Engineer.

Recently, Engineer Rich, of the Central Railroad of New Jersey, fell from his engine cab and was seriously, if not fatally, injured. The engine is of the type where the engineer and fireman are unable to see each other while at work, and the train ran several miles before the fireman discovered the loss of the engineer.

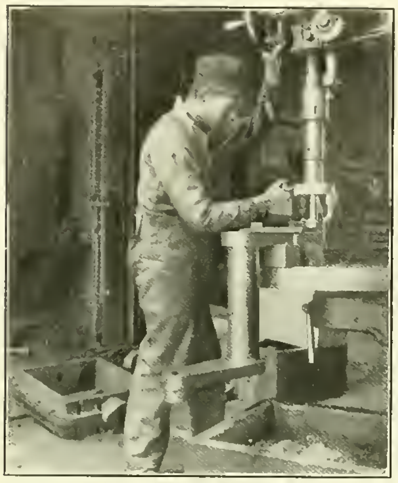
Someone has been kind enough to leave in this office a sample of what is called Johnston's automatic pipe wrench. We have seen a good many pipe wrenches in our day, but we think this one has the greatest range of capacity of anything we have ever seen. It will take in pipes from ¼ inch up to 1½ inches, and when it is necessary to move them around, it will hang on with a tenacity beyond anything we have ever seen. It is called a self-adjusting, self-releasing pipe wrench, and it has these capabilities in a remarkable degree. It is handled by William B. Volger, 88 Chambers street, New York. Those of our readers interested in having at hand a remarkably efficient pipe wrench should send to Mr. Volger for an illustrated catalogue of this wrench.



HOLY PICTURE IN CORNER OF BOILER SHOP—SORMOVO WORKS.

Attachment for Turning Rocker Arm Ends.

Some time ago I promised to send you sketches of a few devices, or time-savers, which I have designed. For the benefit of the readers of LOCOMOTIVE ENGINEERING, I enclose blueprint and photograph of a drill-press attachment for turning



DRILL PRESS ATTACHMENT.

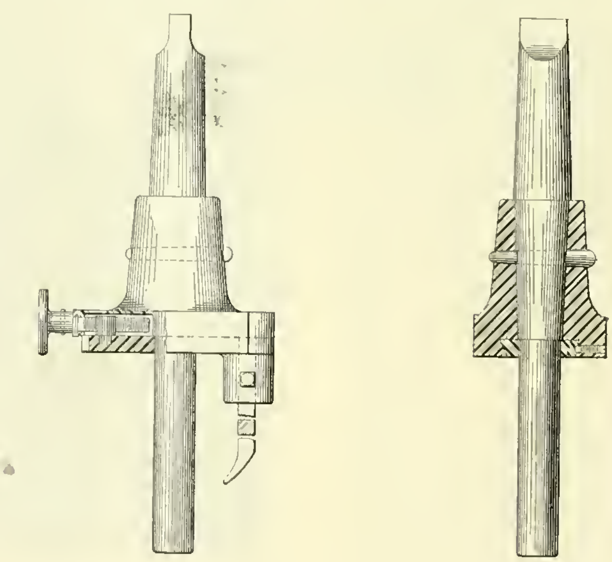
rocker arm ends, which is a great time-saver over the old way of fastening arm to face-plate of lathe. We are not blessed with a horizontal boring machine, so we have to do like others—try and overcome the loss of time some other way. Some of our rocker arms require a 56-inch lathe to swing. So to have to bore a 1⅝-inch hole and turn a 3½ inch diameter with rocker arm blocked out so far from face-plate means for the machinist to be very careful, or else there would be a case of reset work and a little dialogue between man and rocker arm, and we all know what that means—time lost and men discouraged; so if anyone else has the same complaint, here is the remedy:

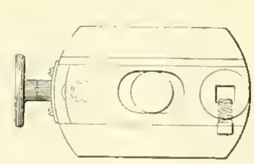
After rocker arm is turned and faced, lay it off for drilling, place two parallel blocks on drill-press table, overhang arm as you see in photograph, cross clamp over arm, using two ¾-inch bolts; drill holes 1-32 inch smaller for reaming. After reaming use brass bushing (loose fit) with small collar to keep it from working down. This bushing is for end of spindle to work in to keep its center and prevent spindle from defacing hole.

The drill-press boy (apprentice) can put on cut and work out fillet while machine is in motion. It is not like the hook tool in bar—have to stop machine, drive in tool, wedge or tighten set-screw. Attachment can be used to bore solid end rod and brasses. Fit bushing in center of table, set tool for boring and do away with unnecessary filing and fitting. Our apprentice boys in their first year do this work, and we save seven-tenths of the old cost, besides having use of lathe and machinist for other work.

J. E. HAYNES.

C. L. & W. Shops, Lorain, O.





Drill Press Attachment for Turning Rocker Arm Ends

A Large Chimney.

The Solvay Process Company have finished the big chimney at their Delray Works, near Detroit, Mich. It is 260 feet high, 51 x 47 feet at the base and 64 feet in circumference at the top where the flange begins.

This smokestack contains 1,250,000 bricks. If they were placed one on top of another, end to end, it is said that the column would be 158 miles high. However, the bricks do better service as a chimney than as a special column one brick wide.

The ladder up the side is a series of hoops, 2 feet apart, large enough so that a man going up is inside the hoops and can be supported at any time on the way up. This should be a safety precaution on such a high climb.

More Than a Million for Equipment.

Few realize how much money the railroads of this country annually spend for equipment. The aggregate sum is an enormous one. The Santa Fé alone has set aside more than a million dollars to spend for that purpose this fall.

Two hundred thousand dollars represents the cost to that road of 300 new ballast and coal cars, of the so-called "hopper" style. By their use it is expected that gravel, crushed stone and other ballast can be placed on the track at a considerable saving in time and labor; the cars will also be used to unload coal into pits.

Fourteen new dining cars, two new composite cars, twenty passenger engines and 500 refrigerator cars are additional important items in this list. The refrigerator cars are mainly for handling California fruit, the traffic in which is assuming large proportions. The other equipment is for the California Limited.

While a million dollars is a big sum of money, it pays to have the very best of everything in railroad equipment, thereby creating new business and retaining old friends.

The discarded dining cars will be transformed into wide-vestibuled parlor, buffet and chair cars, thus materially improving those features of the Atchison, Topeka & Santa Fé service.

Death Struggle on Top of Car.

On the top of a Chicago & Alton passenger train moving at the rate of 40 miles an hour, William Burke, of St. Louis, and an unknown man fought a duel to the death one day last month. The two men were beating their way to Chicago. After the train left East St. Louis the stranger drew a revolver and demanded Burke's money. Burke refused to comply with the request and grappled with his antagonist.

During the desperate struggle which followed the unknown man shot Burke in the side, but the latter finally managed to push him from the top of the coach. He was picked up with his skull crushed in and otherwise horribly injured and barely alive. Burke will recover.

Mr. Geo. W. Hoffman, who makes the United States Metal Polish, reports business very good. Looks as though engines were being kept cleaner than in the past.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

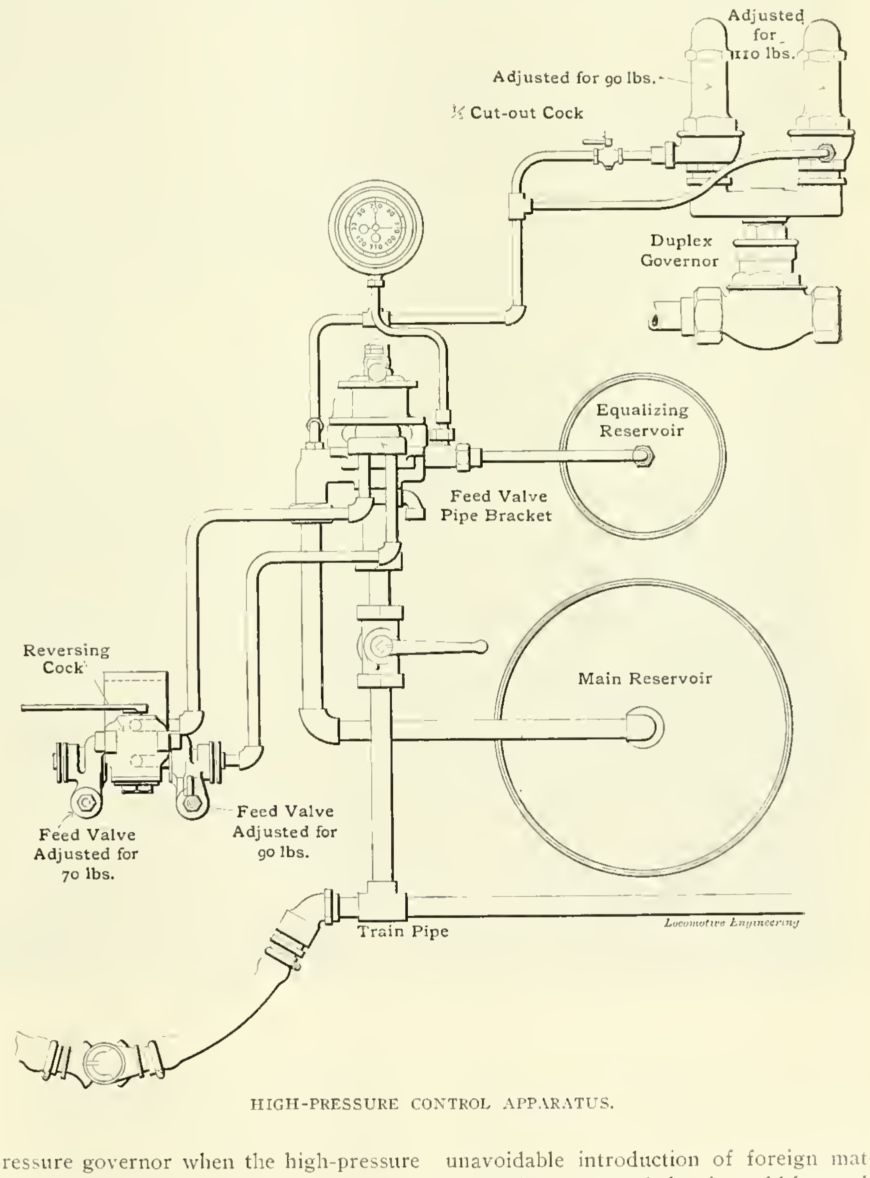
Twisting Strain on Train Pipes.

There is a notable tendency in the piping of freight cars nowadays to merely attach the piping to the car so that the brake may be used, and little effort is made to have the pipe connections sufficiently free that the nut may be entered on the thread connection by hand, and not have to bring the ends together with a pry. This carelessness in piping is very detrimental to the brake, inasmuch as it produces a twisting strain on the triple valve and the gaskets, which is almost sure to cause leaks. This is especially true if any of the bolts or nuts happen to work a little loose. Piping should be fitted to the car so that the connections can be made free, as well as to take care to have no leaks in the train pipe.

High-Pressure Control Apparatus.

The high-pressure control apparatus (or Schedule U), which we illustrate herewith, is a regularly adapted standard schedule furnished by the Westinghouse Air-Brake Company for high-speed brake service and other particular classes of service where high pressure is sometimes desirable and where, at other times, the ordinary pressure will suffice. In high-speed brake service, the same locomotive does not always haul the same train, and such locomotives must be so equipped that they can be prepared in a few moments' time to work in either high-speed or ordinary service. This would ordinarily necessitate a readjustment of the pump governor and feed-valve attachment in going from one service to the other; but Schedule U, the high-pressure control apparatus, makes it possible by the mere turning of the reversing cock to throw the low-pressure governor and low-pressure feed-valve attachment out and the high-pressure parts in.

As will be seen by the cut, the duplex governor consists of a single body and two heads, one of which is adjusted at 90 and the other at 110 pounds. Both heads are connected to the main reservoir pressure, which it is their duty to control. The reversing cock is placed in some convenient and secure place. This cock has two feed-valve attachments, one set for 70 and the other at 90 pounds, either of which may be used and the other rendered inoperative by merely turning the handle of the reversing cock. Thus it will be seen that by turning the handle to the left, the 90-pound pump governor and 70-pound feed attachment (the low-pressure system) will be cut in and the 110-pound governor and 90-pound feed-valve attachment (the high-pressure system) will be thrown out. By reversing the cock handle, the low-pressure system will be thrown out and the high-pressure system will be thrown in. Thus, by simply turning the reversing cock one way or the other, either the high or low-pressure control may be had at will. When using the high-pressure system, the small cut-out cock in the pipe of the low-pressure governor must be closed, else there will be a strong escape and waste of air at the small vent port of the low-pressure governor when the high-pressure system is used.



HIGH-PRESSURE CONTROL APPARATUS.

The high-pressure control apparatus was originally designed for high-speed braked trains, but has become adapted and quite useful in service on mountain grades, for which its utility will be readily recognized. It will be noted that the new slide valve feed-valve attachment is now a standard part of the high-pressure control apparatus.

New "Slide Valve" Feed Valve, or Train-Line Governor.

For some time past, the Westinghouse Air Brake Company has been working toward the production of a new feed valve for the engineer's brake valve that would embody all the recognized advantages of the old form, and, at the same time, govern the train line within closer limits, be less liable to disturbance by reason of the unavoidable introduction of foreign matter, and so arranged that it could be readily taken apart and cleaned without the slightest interference with the adjustment. After extended trials, made under the most severe conditions of service possible, the new "slide-valve" feed valve illustrated herewith seems to meet all the conditions specified and serves to explain its recent adoption by the company as their standard.

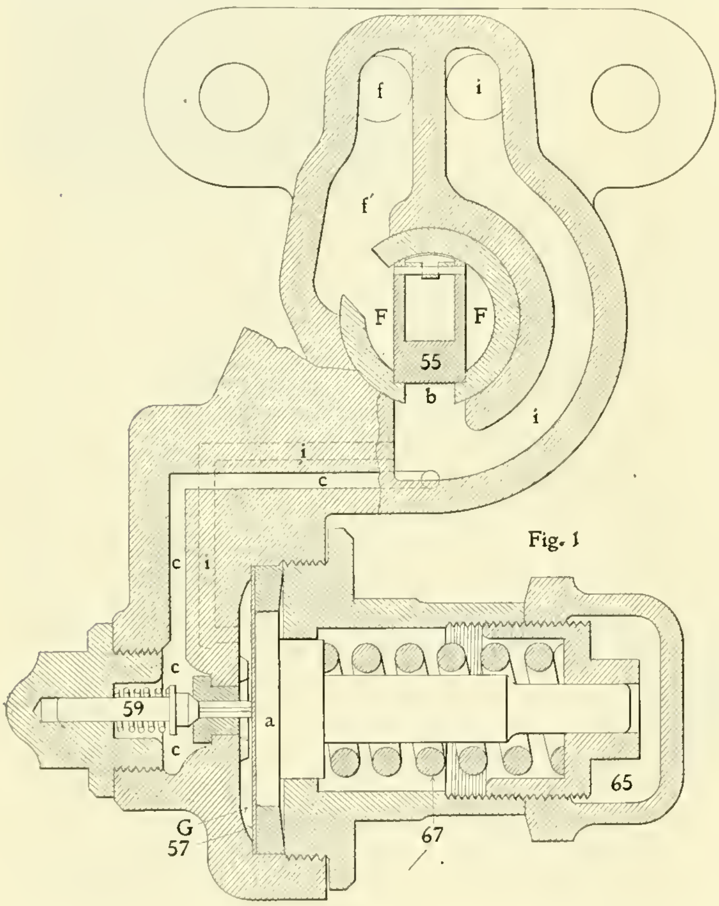
No modification has been made in the

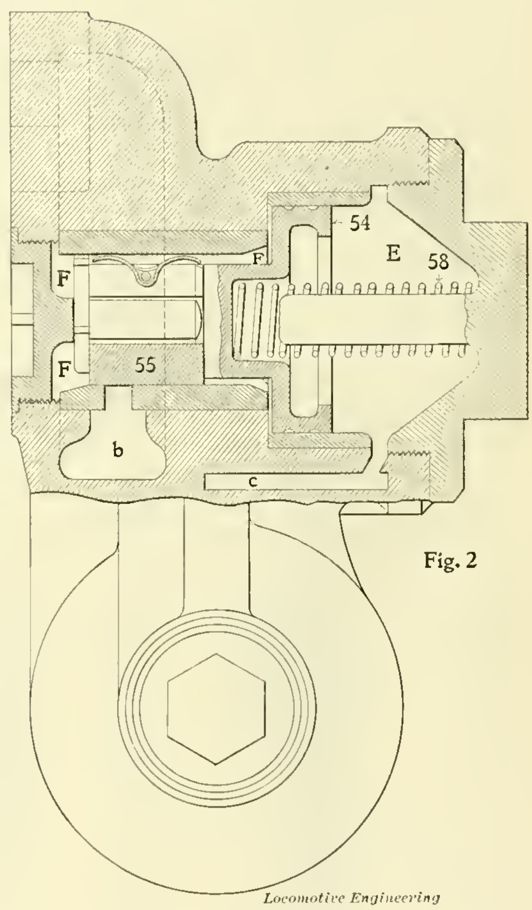
brake valve proper. The method of attachment of the new device is identical with that of the old form, and the two are perfectly interchangeable.

As plainly shown in the cuts, the supply-valve chamber *F* and the ports and passages marked *f′* are in direct communication with the main reservoir, through port *f* of the engineer's brake valve, when the latter is open, while the passage indicated by the letter *i* is a train-pipe extension corresponding to the passage in the brake valve having the same designation. Chamber *E*, which is separated from chamber *F* by supply-valve piston 54, is connected with passage *i*, and thus with the train pipe, through passage *cc*, port *a* (governed by regulating valve 59), and chamber *G* under diaphragm 57. Regulating valve 59 is normally held open by diaphragm 57 and regulating spring 67, the tension of which is adjusted by regulating nut 65. In such case, chamber *E* is in communication with the train line, and contains train-line pressure.

When the handle of the engineer's brake valve is placed in "running position," main-reservoir air is admitted to chamber *F*, forces supply-valve piston 54 forward, carrying supply valve 55 with it, uncovers port *b*, and gains entrance directly into the train line through passage *ii*. The resultant increase in train-line pressure likewise increases the pressure in chamber *G* under diaphragm 57 until it overcomes the tension of regulating spring 67, previously adjusted to yield at 70 pounds or some other desired pressure. The consequent movement of diaphragm 57 allows regulating valve 59 to be seated by its spring, closing port *a* and cutting off all communication between chamber *E* and the train line. The main-reservoir pressure in chamber *F* then equalizes with the pressure in chamber *E*, by leakage past supply-valve piston 54, and supply-valve piston spring 58, previously compressed by the comparatively higher pressure in chamber *F*, now reacts and forces supply valve 55 to its normal position, closes port *b*, and cuts off the communication between the main reservoir and the train line. The reduction of train-line pressure below 70 pounds, or other predetermined limit, reduces the pressure in chamber G, permits regulating spring 67 to react, forces regulating valve 59 from its seat, and allows the accumulated pressure in chamber *E* to exhaust into the train line. The equilibrium between the pressures on opposite sides of supply-valve piston 54 being thus destroyed, the higher main-reservoir pressure in chamber *F* again forces supply valve 55 forward and recharges the train line through port *b*, as before.

Comparing the new valve with the earlier device, in addition to its greater sensitiveness and the facility with which all its working parts can be removed for examination and cleaning, its promptness in charging the train line should be noted. In connection with other features, the employment of a slide valve instead of a poppet valve to govern the train-line supply results in the maintenance of a wide-open port until the predetermined pressure has been reached; while, with the old valve, increasing train-line pressure gradually closed the supply valve, with a consequent delay in recharging.





Locomotive Engineering

THE NEW SLIDE VALVE FEED VALVE.

Oil Cup on Top Head of 9½-inch Air Pump.

Not long ago a prominent air-brake man advised the placing of an oil cup in the steam-chest part of the upper head of the 9½-inch pump in order that the distribution of oil might be better and the quantity consumed less, and we published an illustration of the method used. Should this plan have been adopted with the 8-inch pump, where the oil in following the steam would naturally reach and supply the main steam cylinder before giving any to the valve motion of the pump, the scheme would doubtless have proved more beneficial than in the case of the 9½-inch pump, where the oil naturally follows the steam, and therefore more easily reaches the valve motion.

In his address to the Jacksonville convention, President Brodnax expressed commiseration for the neglected and wandering freight car, and neatly said: "Passenger equipment enjoys high life, when compared to these outcasts of society."

CORRESPONDENCE.

Test to Detect Train-Pipe Leakage.

Editor:

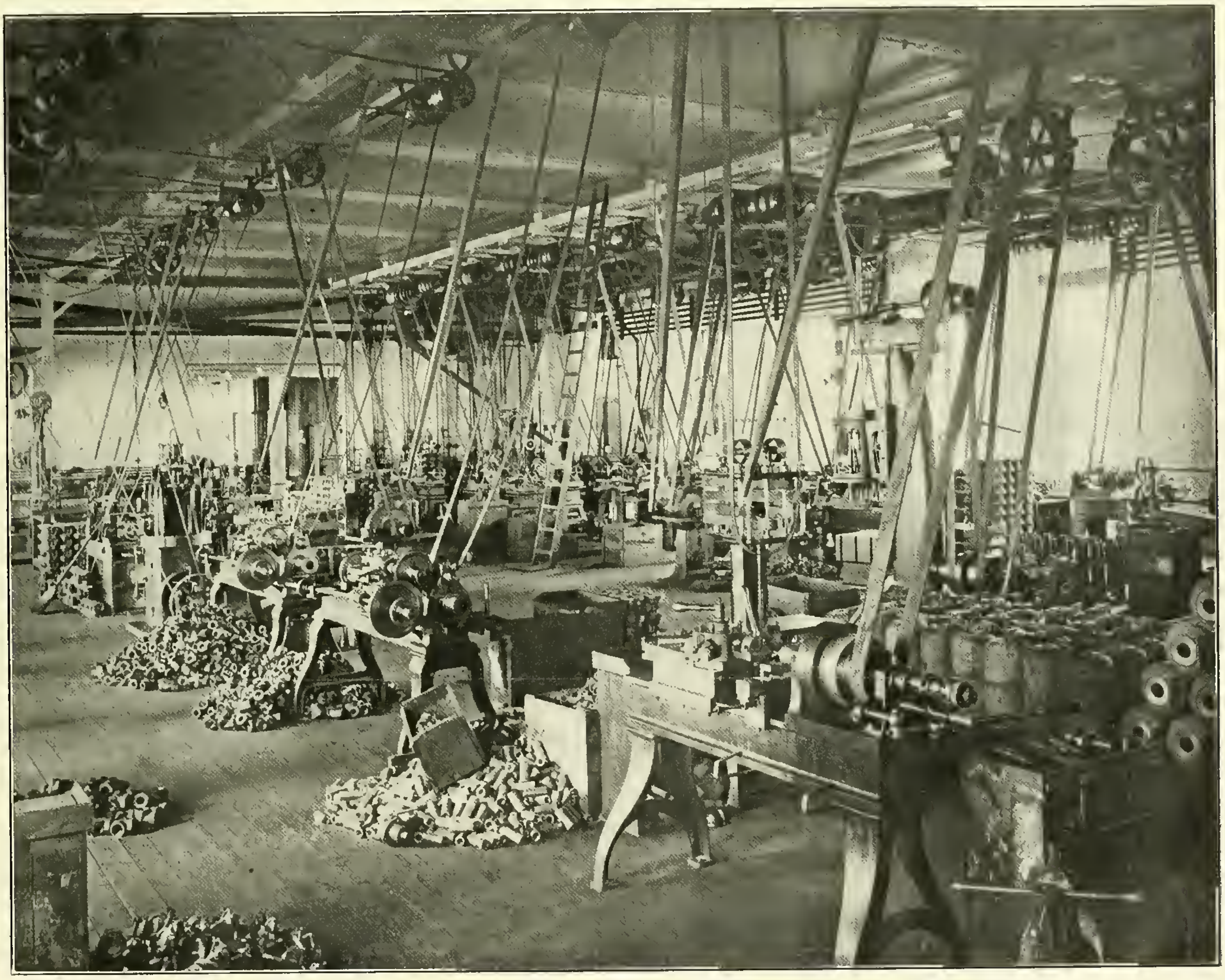
I recently have had rather an interesting experience, which, considering that the maintenance of freight-train brakes is now one of the most important to railroads, will prove of value to other air-brake men who are endeavoring to overcome train-pipe leakage and the heating of air pumps, due to unnecessary hard work in trying to keep up train-line pressure on leaky trains.

On our testing and repair tracks, where all outgoing trains are tested by having the pressure applied to them before the engine couples on, and necessary repairs made and leaking joints tightened before the train is turned over to the train crew, we make the greatest effort to get the brakes in as perfect shape as possible. In one respect only have we been unsuccessful, and that is to get the train pipe as tight as we would like to. The air pump is too severely taxed in pumping against the leaks, even after the inspectors and repairmen have gone over the train, made repairs and taken up leaks. In other words, we have been turning out trains as nearly perfect as a well-organized force of inspectors and repair men and careful methods of inspection could make them. Still the engineers complained that the air pump would frequently heat dangerously in supplying train-pipe leakage on trains which we had taken the utmost pains to make tight and supposed were tight.

It was evident, therefore, that our inspection system, though rigid and efficient as any in the country, was not sufficiently good to detect the troublesome leakage. One day I suspected that the air hose was a possible offender and ordered the inspector, who had a can of soapy water, to take the brush and give the hose a coating of soap suds. At first he applied the suds to the nipple at the angle cock and at the hose coupling. I assured him I wanted the entire hose painted with suds, whereupon he coated the hose with suds from one angle cock to the other. Immediately bubbles began to form, grow surprisingly large and burst, showing that the air was leaking from the hose over its entire surface from numerous small pores. All the hose on the train were similarly tested, faulty hose being removed and replaced with new ones. Since then the soap-suds test has been one of the features of our inspection, and we have tested about four thousand hose, 6 per cent. of which have been removed on account of leaking and have been replaced with new hose. Thirty per cent. of the number removed showed abrasion at or near the nipple. The other 70 per cent. never would have been condemned from outward appearance. Freight-car hose only has been considered thus far.

The soap-suds test has been carried into our passenger service, and although none of them has shown abrasion, yet 11 per cent. of all passenger hose tested have been removed on account of leakage through the outside surface of the hose that had not, and could not, be detected by the ordinary method of inspection. As a proof of the potency of this test, I might say that the engineers have come to me voluntarily and commented upon the ease with which the air pump can now supply our fifty and sixty-car trains since this test was introduced; and this will probably be the first knowledge that many of the men have of the new test.

C. C. Farmer,
Gen'l A. B. Insp'r Cent. R. R. of N. J.
Jersey City, N. J.



TRIPLE-VALVE ROOM IN THE WESTINGHOUSE AIR-BRAKE COMPANY'S SHOP, HAMILTON, ONT.

Device for Grinding Packing Ring Into Bush of Triple Valves.

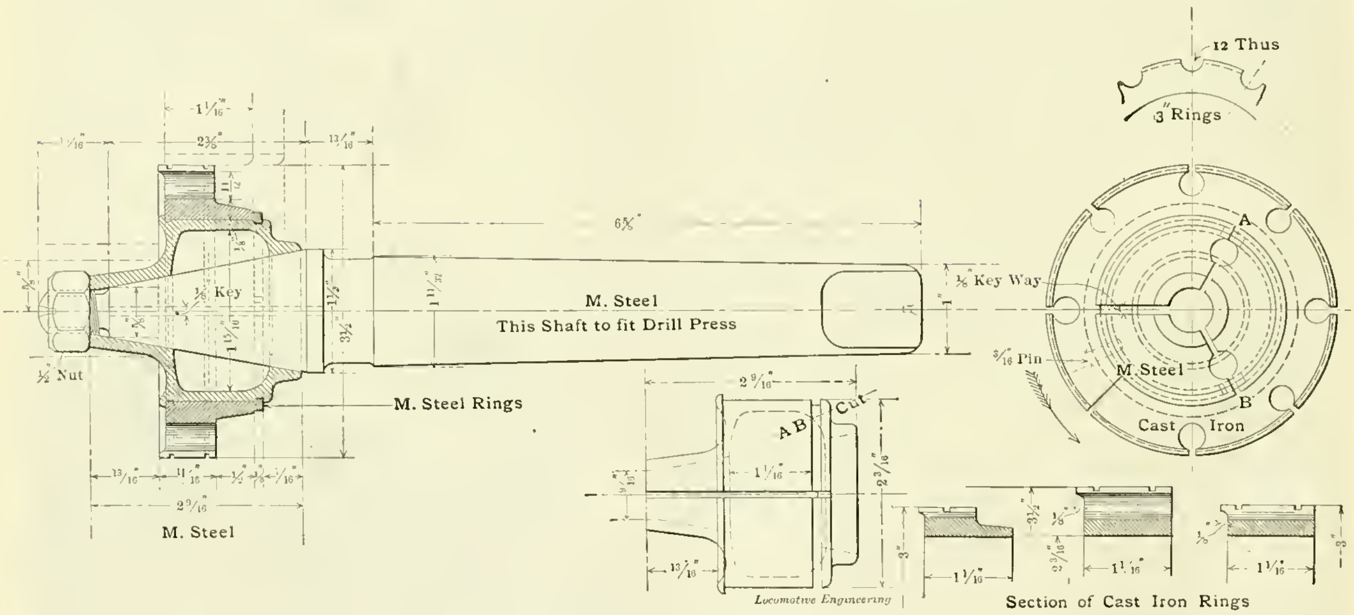
Editor:

In reply to request of Mr. R. G. Shaffer, in the October number of LOCOMOTIVE ENGINEERING, page 443, I send you a drawing of an adjustable tool for grinding the triple valve bushing that the piston works in, it being required to be as near air tight as possible. This tool works perfectly. It is used in the bushing after the bushing has been bored in a lathe. It will clean up the work quickly. One set of cast-iron rings will grind seventy-five or one hundred valve bushings before renewing is necessary. I use pumice stone with oil for grinding, and run at fast speed on a drill press, using the quick-return lever, working it up and down in the bushing. Fit the ring in the bushing so it will be tight, put the ring in the piston, then rub it in the bushing with lard oil only. Scrape or file the high parts of the ring and rub it in until it burnishes and works easy. If carefully done, it will make a good job.

I have fitted up one hundred new valves this way. These valves met the requirement of test No. 5 in the Master Car Builders' Code. They also complied with test No. 8. These two tests show perfect fitting of the rings, and I also released the valve under the conditions of test No. 5, through a 1-64 inch opening. Having had practical experience with it and good results, I can highly recommend it.

MAURY W. HIBBARD.

Chicago, Ill.



DEVICE FOR GRINDING TRIPLE-VALVE PACKING RINGS.

Failure of Equalizing Piston to Seat.

Editor:

On page 311 of July issue of your paper I notice an article from Mr. F. L. Dillon in which he advises engineers what to do in case the equalizing piston fails to seat after making a service application.

What Mr. Dillon has to say relative to the matter is true to a certain extent; but it occurs to me that engineers should not be encouraged in pounding the brake valve when, in many cases, the trouble is due to the manner in which brake valve is handled. It also occurs to me that this procedure in getting the piston seated is faulty and cannot fail of poor results, inasmuch that the piston failing to seat is often due to scale and other hard substance lodging on seat of valve, and which would be forced into the seat should we jam the piston down by throwing main-reservoir pressure on top of it. Taking pressure from beneath would be equally as bad, inasmuch that pressure *D* would force the piston down, causing damage to the seat.

My belief is that much better results would be obtained by closing the cut-out cock under the brake valve, then make a slight reduction and return the valve to the running position. This would cause the piston to raise full travel, and the violent rush of air would most likely dislodge the dirt. However, should the engineer frequently complain of the piston failing to seat, I should want to know to what extent he had reduced the brake-pipe pressure at the time the piston failed to seat. It will be found in many cases that the trouble is oftener with the engineer than with the brake valve, for should more than a 20-pound reduction be made, the higher pressure in the brake cylinder and auxiliary reservoir will leak back through a faulty check valve and keep the equalizing piston from seating. O. B. J.

Detroit, Mich.

Brake Test of the Large Capacity Car on a Heavy Grade.

Editor:

Owing to the fear expressed by some persons that the air brake would prove inadequate to safely control trains of large capacity cars down mountain grades, the following test may prove interesting to your readers.

On July 24, 1900, a train of forty Butte, Anaconda & Pacific Railway 100,000-pound capacity pressed-steel ore cars, loaded to an average of 55 tons each, was held by the air brake alone from Butte Yard to Rocker, a distance of 5 miles. The maximum grade is 132 feet per mile, and the only material reductions from this are on curves, of which there are many.

The cars have Westinghouse brakes, leveraged to develop, in an emergency application from 70 pounds, 80 per cent. of the light weight of 34,800 pounds each. Full service from 80 pounds, with the retaining valve, would equal about 20.5 per cent. of the loaded weight per car on this trip.

No special preparation was made for the test, nor was the engineer, Mr. Thos. Howson, given any instruction other than, by Mr. Harrity, master mechanic, to handle the train in the manner usual with the lighter cars.

The engine was fitted with a 9½-inch pump, "Schedule U," or two-pressure system, and two main reservoirs having a combined capacity of 33,000 cubic inches. The main reservoir pressure was 120 pounds, and the train pipe 80 pounds. The weight of the engine and tender was 145 tons, which, with the cars and their load, made a total tonnage of 3,041. To expedite work, the engine backs all trains down the hill; hence it was not possible to increase the brake efficiency by the use of sand. The cars were fitted with the "Diamond S" brake shoe. The average speed was about 15 miles per hour. As the train was slowed down for recharging, the maximum materially exceeded this.

A train pipe pressure chart was taken, the recording gage being connected to the front end of the train; the engine being at the rear, as before mentioned. To facilitate an explanation of the chart, the application lines are numbered and the release lines lettered.

Referring to the chart, it will be seen that the train started from Butte Yard at about 1.09 P. M. By full release position the train pipe pressure was raised to 87.5 pounds, but reduced a little before application, due to leakage and the valve handle having been placed on lap.

Application 1 (see chart)—Reduction, 8 pounds; leakage, 11 pounds; total, 19 pounds; time, 2 minutes.

Release (a)—Slow speed and all but rear of train on straight track and maximum grade; rise, 15 pounds; time, 30 seconds; pressure, 81.5 pounds.

Application 2—Emergency due to train parting and caused by coupler unlocking, from short chain, as slack ran out. Train stopped quickly, with no shock. (All cars were fitted with the Westinghouse friction draft gear.)

Release (b)—15 pounds rise in 2 minutes from back leakage after angle cock was closed. Quick rise 24 pounds with brake valve in full release, then placed in running position. Rise by steps from 52.5 to 72.5 pounds through moving from running to release positions and back, then left in release, recharging to 79 pounds. Train could not be started with steam until a few retaining valves near engine were turned down. Start indicated by crossline near maximum pressure.

Application 3—Reduction, 10 pounds; leakage, 7 pounds; total, 17 pounds; time, 1 minute and 45 seconds.

Release (c)—Quick rise of 13 pounds; slow rise, 3 pounds; pressure, 79 pounds; time, 1 minute.

Application 4—Reduction, 4 pounds; leakage, 13 pounds; total, 17 pounds; time, 2 minutes and 40 seconds.

Release (d)—Quick rise, 14 pounds; slow rise, 2 pounds; time, 1 minute and 15 seconds; pressure, 78 pounds.

Application 5—Reduction, 3 pounds; leakage, 2 pounds; reduction, 2 pounds; leakage, 8 pounds; reduction, 2 pounds; leakage, 1 pound; total, 18 pounds; time, 2 minutes and 20 seconds.

Release (e)—Quick rise, 16 pounds; slow rise, 3 pounds; time, 1 minute and 45 seconds; pressure, 79 pounds.

Application 6—Reduction, 5 pounds; leakage, 3 pounds; reduction, 2 pounds; leakage, 8 pounds; total, 18 pounds; time, 2 minutes and 25 seconds.

Release (f)—Quick rise, 15 pounds; slow rise, 1.5 pounds; time, 1 minute and 10 seconds; pressure, 77 pounds.

Application 7—Reduction, 4 pounds; leakage, 2 pounds; reduction, 2 pounds; leakage, 1 pound; reduction, 3 pounds; leakage, 4 pounds; reduction, 2 pounds; leakage, 1 pound; reduction, 1 pound; leakage, 1 pound; total, 21 pounds; time, 2 minutes and 30 seconds. Stop at Rocker.

The wheel temperature brake test made at the foot of the grade demonstrated there were no defective brakes in the train. One brake had held a little more than the average and another a little less. The tender brake had done its share, but the driver brake much less than its proportion. However, thin tires justified this. The heat of the car wheels was not excessive, being no more than is usual with ore and coal trains of smaller capacity cars on other heavy grades. In fact, the maximum was materially lower, owing to the uniform distribution of work.

Engineer Howson is to be commended for the good judgment displayed, the train at all times being under full control. At the times when the applications were heaviest the speed was low and rapidly falling. However, he agreed that the results would have been even more satisfactory had the initial reductions with applications 4 to 7 been a little heavier and if two or three more applications had been made. This would have reduced the total of each reduction and resulted in a more uniform speed. The light initial reduction resulted in a speed much above the average for the trip, the object being to increase the distance run before train pipe leakage would slow down the train. With a train having much brake cylinder leakage this method would invite trouble. Train pipe leakage was quite heavy.

The test demonstrated that such trains can be held down the grade with ample safety. In addition to the improvement that would follow the different method of brake handling, as described, there is much possible yet in reserve, viz.: a larger main reservoir capacity, which is needed; two pumps on hill engines, a higher train pipe pressure than 80 pounds, lower speed, the water brake and, by placing the engine ahead, the use of sand.

This train was much easier to control than many met with on 116-foot grades and where the cars do not exceed 30-ton capacity. The reason lies in all cars being fitted with air brakes in good order, properly leveraged and having 15-pound pressure retaining valves.

Could any advocate of a heavier retaining valve have seen the difficulty experienced in starting the train following its separation, he would have been convinced of the adequacy of the standard valve *when maintained.* F. B. FARMER.

St. Paul, Minn.

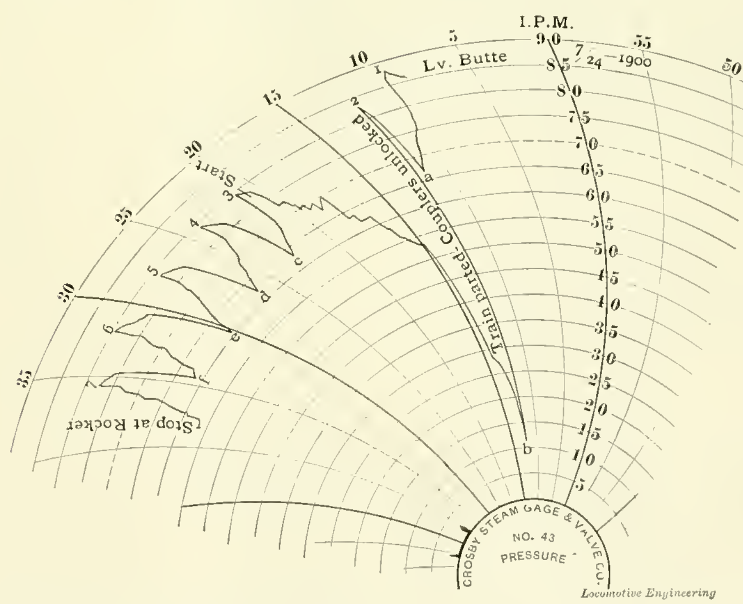


CHART SHOWING BRAKE TEST OF LARGE CAPACITY CARS ON HEAVY MOUNTAIN GRADES.

Improved Oil Cup for Air Cylinder of Air Pumps.

Editor:

I am sending you a drawing of two cylinder oil cups which may interest some LOCOMOTIVE ENGINEERING readers.

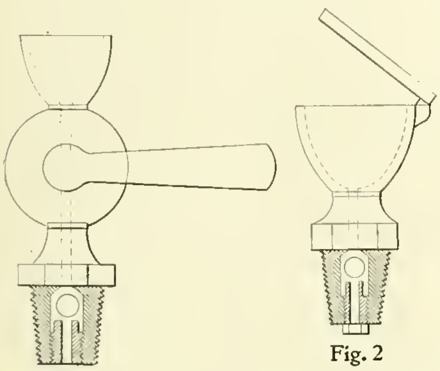


Fig. 1 Fig. 2

AUTOMATIC OIL PUMP FOR AIR CYLINDER OF PUMP.

Fig. 1 shows an ordinary oil cup with ¼-inch ball in the lower end, which acts as a check valve. Fig. 2 shows a drawing of a common oil cup without the cut-out plug, and which also has a hinged lid to keep the dirt out. These cups are made by simply drilling a 5-16 inch hole in the lower end and inserting a ¼-inch ball and also a stop-ring to prevent the ball from dropping out.

The object of this cup is to allow oil to be put in the air cylinder without blowing it all over the pump, which is done with old cup. As will be seen, when the oil is put in the cup, the oil will be drawn in on the down stroke, and after the pump is reversed, the back pressure will force the ball to its seat and automatically close the valve and prevent the oil from being blown out.

The plug which acts as a stop-ring is cut crosswise on the upper end to prevent the ball from forming a joint while the piston is on the down stroke, and is screwed far enough in as to allow about 1-16 inch play for the ball.

These valves have been tested, and were found to work entirely satisfactory, and equally well at any speed of the pump, with either light or heavy oil. Another thing I claim for this cup No. 2 is that it is cheap and can be made all in the rough, with the exception of the thread end, and is also easy to clean, as it can be easily taken out and the plug (which has a square extension) removed, allowing the ball to drop out without first having to take the cut-out plug out, as with the ordinary cup now used.

Winona, Minn. F. W. Ramer,
A.-B. Insp., C. & N. W. Shops.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(131) F. J. B., Toledo, O., asks:

1. What should be the length over all of main valve of the 8-inch pump? A.—1. 10 and 19-64 inches. 2. What should be the distance between piston heads of the main valve; also that between outside faces of the heads? A.—2. The length between heads should be 7 and 15-16 inches, and that between outside head faces 9 and 13-16 inches.

(132) F. J. B., Toledo, O., asks:

What should be the length of the stop in the lower steam cylinder head of the 8-inch air pump that the main steam valve rests on when the valve is as far down as it will go? A.—It is not as important what the length of the stop shall be as is the distance from the top of the stop to the under face of the copper gasket. This latter measurement should be 25-64 inch.

(133) C. A. P., Chicago, Ill., writes:

I am one of your subscribers and would like to know how the duplex governor and high-speed valves operate, and would thank you for the information. A.—See elsewhere in this department the illustration and description of the duplex governor and double feed valves used on locomotives in high-speed brake service, and also in service where high pressures are required over the road one way and lower pressures the other way.

(134) Wm. W., Louisville, Ky., writes:

Will a cam-driver brake set the brake harder with a long or short piston travel, provided the air pressure is the same in the brake cylinders in both cases? I think it will set harder with long travel. Am I right? A.—The brake will set tighter with the longer piston travel than with the shorter, for the reason that with the long travel the cam screws are brought more nearly to a horizontal line where the greatest power of the brake is obtained. In other words, with the short travel the cams stand higher from the rail, have a certain downward thrust as well as a thrust toward the center of the wheel. With the longer travel, the cams are nearer the rail and the downward thrust is less, and the thrust toward the center of the wheel is greater. Consequently, under the conditions you submit, the long travel piston will do the best braking.

(135) J. O. R., Hornellsville, N. Y., writes:

Will a tire dressing brake shoe dress down the tire as the claim is made for it, and at the same time give good braking power? It seems to me that the shoe and the rail together would make the shoe rough and grooved. A.—A good tire dressing shoe is a good thing, especially on a locomotive driving wheel. It is well known that the part of the tire coming in contact with the rail wears away most rapidly. But a shoe properly designed and with the metal properly distributed, will prevent this. The best designed shoe is the skeleton shoe, which is cast open at the tread contact and made to do the rubbing on the outer rim of the tire and the flange. In this way the braking is really done on these parts, at the same time keeping them worn down, and the open part of the shoe, of course, does no work. The tire dressing shoe will hold just as hard as the plain shoe.

(136) T. M. McA., Roanoke, Va., writes:

Why does my engine air gage show 70 pounds train line and 90 pounds main reservoir with engine when she is not coupled to any cars, but as soon as coupled up to train, the train line hand drops to 55 sometimes, and often more? When the engine is cut off afterwards, the hands stand all right again. I have the D-5 (1892 model) brake valve. A.—This question has been asked many times recently and answered. As the train line pressure approaches 70 pounds, or whatever pressure the feed valve attachment is set for, the supply valve begins to close, thereby making a smaller opening through the brake valve to the train pipe. If the train line is positively tight, the supply valve will finally close and train line pointer on the gage will register full train line pressure. However, should the train line leak, the supply valve cannot close, but must remain open and feed the leaks. If the leaks are heavy the valve will stay open, and the gage will register short of full train line pressure in proportion to the leakage. See illustration of the new slide valve feed valve elsewhere in this department.

(137) H. W. B., Sparta, Tenn., writes:

I was running a ten-wheel engine and found the pin loose on the left back driving wheel. I disconnected the side rods at the knuckle joints. When I applied the brake the back drivers would slide. Engine was equipped with the Westinghouse cam-driver brake. Why did drivers skid when rods were taken down, and not before? A.—The retarding effect of the brake shoes is not the same on both wheels when the cam brake is used, because of the effect which the angle of the brake shoe hanger has when brakes are applied. It will be observed that the hanger or lever tends to force one shoe against the wheel with more power than the other, depending on which way the wheel is turning. While the side rods are coupled up they help to keep the wheels all turning alike. When the rod is off, the wheel that gets the wedging action from the hanger will likely slide. Cam brakes on ten-wheel engines are sometimes so proportioned that braking power for the whole engine is exerted on the two pairs of wheels, and the side rods to the unbraked are depended upon to even up the braking power. This method is wrong, of course; each wheel should have a brake shoe, and all shoes should pull in the same direction to procure the best results.

(138) D. H. S., Greeley, Colo., writes:

When a train breaks in two and all air escapes from train pipe, do brakes apply any harder than with a full service application? We would get an emergency application in this case, but as all air escapes from the train pipe, how can it increase the braking power? It is claimed that in an emergency application the braking power is increased 20 per cent. A.—As you doubtless know, the quick-action triple valve is really two valves in one. One half, the service portion of the valve, works pressure from the auxiliary reservoir into the brake cylinder on service applications, when a gradual reduction is made in train pipe pressure. During the service application the other half of the triple lies idle and does nothing. In an emergency application, however, when the train pipe reduction is sudden, the latter half of the valve, or the quick-action portion, draws a certain proportion of pressure from the train pipe and puts it in the brake cylinder. The service feature works also, and throws auxiliary reservoir pressure into the brake cylinder on top of the train pipe pressure which the quick-action half of the triple has already placed there. The train pipe pressure going to brake cylinder requires but a small fraction of a second to get there. The air which we hear escaping from the brake valve in emergency application or at the broken hose is air which the triple has refused and cannot use. In other words, the 20 per cent. increased pressure in quick action requires only a small part of the train pipe air, and gets it quickly.

At a recent meeting at Lawrence the stockholders of the Boston & Maine voted unanimously to purchase the property of the Central Massachusetts Railroad Company.

Personal Department.

Mr. A. Bohlinger has been appointed assistant superintendent of the Arkansas Southern.

Mr. W. S. Jones has been appointed general superintendent of the Rutland Railroad at St. Albans, Vt.

Mr. J. H. Fildes has accepted a position with the Lehigh Valley as general foreman at South Easton, Pa.

Mr. N. Snyder has been appointed master mechanic of the Louisiana & Arkansas, with office at Stamps, Ark.

Mr. E. D. Sietz has been appointed purchasing agent of the Louisville, Evansville & St. Louis at Louisville, Ky.

Mr. Wm. Singer has been appointed master car builder of the Pittsburg, Shawmut & Northern at St. Mary's, Pa.

Mr. W. E. Quinn has been appointed superintendent of the Shreveport & Red River Valley at Shreveport, Texas.

Mr. S. D. Kinney has been appointed assistant division master mechanic of the Chicago & Alton at Bloomington, Ill.

Mr. John M. Collins has been appointed purchasing agent of the West Virginia & Southern; office at Marmet, W. Va.

Mr. H. L. Hungerford has been appointed tr inmaster of the Mobile division of the Mobile & Ohio at Meridian, Miss.

Mr. M. Goodrich, general foreman of the New York & Ottawa, has been appointed master mechanic at Ottawa, Ont.

Mr. E. J. Young has been appointed general foreman of the mechanical department of the Illinois Central at Clinton, Ill.

Mr. W. B. Butterfield has been appointed general foreman of the Central of New Jersey, with headquarters at Jersey City, N. J.

Mr. D. F. Maroney has been appointed general superintendent of the Pittsburgh division of the Baltimore & Ohio at Pittsburgh, Pa.

Mr. W. J. McKee has been appointed superintendent of the Missouri Pacific at Little Rock, Ark., succeeding Mr. J. D. Moore, resigned.

Mr. B. A. Gibbs has been appointed master mechanic of the Mason City & Fort Dodge, at Fort Dodge, Iowa, vice Mr. E. H. Mante.

Mr. J. H. Green has been appointed master mechanic of the Atlantic & North Carolina at New Bern, N. C., vice Mr. W. R. Warters, resigned.

The South Georgia Railway have built new shops at Heartpine, Ga., and Mr. G. V. Wagner has been appointed master mechanic at that place.

Mr. F. N. Dean has been appointed assistant superintendent of motive power of the Chicago, St. Paul, Minneapolis & Omaha at Sioux City, Ia.

Mr. E. C. Blanchard has been appointed division superintendent of the Northern Pacific at Minneapolis, Minn., in place of Mr. A. E. Law, promoted.

Mr. S. L. Trotter has been appointed master mechanic of the Gulf, Beaumont & Kansas City at Beaumont, Texas, vice Mr. W. A. Meagher, resigned.

Mr. A. S. Begg has been appointed assistant superintendent of the Middle division of the Grand Trunk at London, Ont., vice Mr. F. W. Egan, promoted.

Mr. P. H. Cosgrove, general foreman of the car department of the St. Joseph & Grand Island, has resigned to accept a similar position with the Colorado Midland.

Mr. D. Witherspoon has been appointed master mechanic and master car builder of the Washburn, Bayfield & Iron River at Washburn, Wis., vice Mr. M. W. Brown, resigned.

Mr. W. H. Wright, trainmaster at Waycross, Ga., on the Plant System, has been promoted to the position of superintendent of the Charleston & Savannah division at Savannah, Ga.

Mr. C. Skinner, master mechanic of the Toledo, St. Louis & Western, has been appointed master mechanic of the Chicago & Alton at Slater, Mo., succeeding Mr. W. J. Bennett, resigned.

Mr. G. M. Basford, editor of the *American Engineer,* gave an address before the engineering students of Purdue University, October 17th, on the subject of "After Graduation, What Next?"

Mr. Geo. J. Walters, formerly assistant traveling engineer, has been promoted to road foreman of engines on the New York Central & Hudson River Railroad, vice Mr. C. H. Hogan, promoted.

Mr. J. W. Hardy has resigned his position with the International Correspondence Schools to accept a position as road foreman of engines with the Colorado Midland at Colorado City, Colo.

Mr. George C. Jones, superintendent of the Middle division of the Grand Trunk at Toronto, Ont., has been transferred to the Eastern division at Montreal, in place of Mr. J. M. Herbert, resigned.

Mr. F. W. Egan, assistant superintendent of the Middle division of the Grand Trunk at London, Ont., has been appointed superintendent of that division at Toronto, vice Mr. G. C. Jones, promoted.

Mr. W. A. Garrett, superintendent of the Philadelphia division, has been appointed superintendent of the New York division, with headquarters at Philadelphia, succeeding Mr. E. C. Tomlinson, resigned.

Mr. T. F. Dunaway has been appointed manager of the Nevada-California-Oregon Railroad at Reno, Nev., vice Mr. E. Gest, resigned. He was formerly general superintendent of the Colorado & Southern.

Mr. Wm. Elmer has been appointed assistant to Master Mechanic Stratton, of the Pennsylvania at Altoona, Pa., vice Mr. J. T. Wallis, recently appointed assistant to Mr. F. D. Casanave, chief of motive power.

Mr. Frank S. Stevens, division engineer of the Philadelphia & Reading at Reading, Pa., has been promoted to the position of superintendent of the Reading and Lebanon divisions at Reading, Pa., vice W. G. Besler, promoted.

Mr. W. G. Besler, superintendent of the Reading and Lebanon divisions of the Philadelphia & Reading, has been appointed general superintendent, with office at Reading, Pa., succeeding Mr. I. A. Swiegard, resigned.

Mr. John M. Sheetz has been promoted from locomotive engineer on the main line of the Reading Railway to road foreman of engines, with headquarters at Reading, Pa., vice Mr. D. M. Deeter, promoted to New York division.

Mr. C. W. Cross, foreman of the Pennsylvania shops at Allegheny, Pa., has resigned to accept a position as master mechanic of the Michigan division of the Lake Shore & Michigan Southern at Elkhart, Ind., vice Mr. J. O. Bradeen, resigned.

Mr. James M. Herbert, who resigned a short time ago as superintendent of the Eastern division of the Grand Trunk, has accepted a position as division superintendent of the Misouri Pacific at Osawatomie, Kan., succeeding Mr. S. T. Shankland, resigned.

Mr. W. J. Bennett has been appointed general foreman of the shops of the Chicago, Indianapolis & Louisville at Lafayette, Ind., succeeding Mr. Frank J. Winkles. Mr. Bennett was formerly master mechanic of the Western division of the Chicago & Alton.

The following changes have been made on the Chicago & Alton: Mr. M. Sheehan, trainmaster at Slater, Mo., has been transferred to Roodhouse, Ill., in place of Mr. S. M. Drake, transferred, and Mr. S. J. McEwen has been appointed to succeed Mr. Sheehan at Slater.

Mr. William Forsyth, for many years mechanical engineer of the Chicago, Burlington & Quincy, and for the past few years superintendent of motive power of the Northern Pacific, has accepted the position of mechanical engineer of the Pennsylvania Coal Company at Scra ton, Pa.

Mr. J. L. Welch, assistant superintendent of the Nashville & Decatur and Nashville, Florence & Sheffield branches of the Louisville & Nashville, has been promoted to the position of superintendent of the South & North Alabama and Birmingham mineral divisions at Birmingham, Ala., succeeding Mr. W. M. Newbold, deceased.

The following changes have been made on the St. Louis & San Francisco: Mr. B. F. Yoakum, from vice-president and general manager to president; Mr. J. A. Davison, from general superintendent to general manager; Mr. C. R. Grey, from division superintendent to general superintendent, headquarters at St. Louis; Mr. J. A. Quinn, general yard master to division superintendent at Monett, Mo.

Mr. T. J. Mendenhall has been appointed road foreman of engines on the Kansas City Southern, with headquarters at Pittsburg, Kan. Mr. Mendenhall was a locomotive engineer on the New York division of the Pennsylvania Railroad for about twenty years, most of the time in the fast passenger service. He is a member of the Traveling Engineers' Association and of the Air-Brake Men's Association, and is very well equipped for his new position.

Mr. T. M. Ramsdell has been appointed general car inspector for the whole Santa Fé system. Mr. Ramsdell began railroad service on the Burlington, Cedar Rapids & Northern at Cedar Rapids, where he learned pattern making. He then went to the Iowa Central, thence to Wisconsin Central, where he worked as pattern-maker, draftsman and general foreman of the car department. About two years ago he was appointed master car builder of the Santa Fé at Albuquerque, N. M.

Superintendent Geo. W. Adams, of the Hawaiian C. & S. Railroad, is fast bringing his road into line, putting on an Eastern appearance. The laying of new steel has been brought to a halt for the want of rails. The ship from New York, due at Kahului September 1st with 60 miles of new steel rails, has been reported as put in to the Falkland Islands in a leaky condition. This will retard the work somewhat; but the grading on the Spanish division goes on just the same. Another five-mile branch is being surveyed, which will be called the mountain division. Five hundred new box cars and twenty-five flat cars are being built for the road by W. C. Gregg & Co., of Honolulu, H. I.

Mr. H. A. Tice, superintendent of the Panhandle divison of the Atchison, Topeka & Santa Fé at Wellington, Kan., has been appointed superintendent of the Oklahoma division, with headquarters at Wichita, Kan., in place of Mr. D. D. Bailey, who has been transferred to other duties. Mr. F. T. Dolan has been appointed superintendent of the Chicago division, with headquarters at Chicago, Ill., in place of Mr. Avery Turner, who has been appointed superintendent of the Middle division, with headquarters at Newton, Kan., to succeed Mr. Dolan. Mr. George E. Ayer, trainmaster at San Marcial, N. M., has been appointed superintendent of the Panhandle division, with headquarters at Wellington, Kan., in place of Mr. Tice.

Mr. Chas. H. Hogan has been appointed master mechanic of the Western division of the New York Central & Hudson River Railroad, with headquarters at East Buffalo; effective October 1st. He will also have charge of the Dunkirk, Allegheny Valley & Pittsburgh Railroad. Mr. Hogan began work as a locomotive engineer on the Bridger division of the Union Pacific Railway in September, 1869, b t returned to the New York Central in August, 1871, where he ran a locomotive till July, 1893, when he was promoted to traveling engineer. Since December, 1893, he has also had charge of the distribution of power on that division. Mr. Hogan has been an active member of the Traveling Engineers' Association since it first started. He is now the president. Mr. Hogan is well equipped for his new duties, and Locomotive Engineering wishes success to one of its firm friends.

Mr. Charles A. Beach, who was recently appointed superintendent of the Atlantic City division of the Philadelphia & Reading, has been transferred to the Philadelphia division of the same road, with headquarters at Philadelphia, Pa., in place of Mr. W. A. Garrett, transferred. Mr. A. G. McCausland, superintendent of the Wilmington & Columbia division, has been appointed superintendent of the Atlantic City Railroad, with headquarters at Camden, N. J., in place of Mr. Beach. Additional appointments are as follows: John H. Frech, trainmaster of the main line, with headquarters at Reading; G. O. Sarvis, trainmaster of the Lebanon Valley and East Pennsylvania branches, with headquarters in Reading; C. M. Himmelberger, trainmaster of the P. H. & P. and the G. & H. branches, vice H. B. Voorhees, transferred to the W. & C. division, with headquarters at Harrisburg; D. W. Saterlee, assistant trainmaster of the Perkiomen Railroad, with headquarters at East Penn Junction.

Mr. John A. Middleton, who has recently been made third vice-president of the Erie Railroad, is one of the most popular rising railroad men in the country. He went to New York as chief clerk for Mr. E. B. Thomas, then general manager of the Erie, and very quickly acquired popularity for the genial way he had of treating callers. He is an unusually well educated man, which, combined with excellent executive ability recommended him for advancement, and in a few years he was made secretary of the Erie Railroad Company. His latest rise will give pleasure to a host of friends.

QUESTIONS ANSWERED.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(89) J. Y. S., Argenta, Ark., asks how steel tires are made. A.—There are different processes, but the weldless tire, being most common, will be described. First there is an ingot cast, and this is worked into a comparatively small ring suitable for rolling. It is then placed in a machine having three rolls, one inside and two outside, and rolled until it is of the desired size and shape.

(90) C. B., Aurora, Ill., writes:

What is the difference between a direct and indirect valve motion for a locomotive? A.—Most American locomotives have indirect valve motion, since the link block is connected with the end of a rocker arm that transmits through the rocker the throw of the eccentric to the valve stem. With a direct valve motion the link block transmits to the valve the motion of the eccentric without the intervention of a rocker.

(91) C. Y., Buffalo, N. Y., writes:

I have read that the Traveling Engineers' Association have been investigating the indicator. How could I become familiar with the working of that instrument? A.—Get the book, "Indicator Practice and Steam Engine Economy," by Hemenway, and study it. Then try to get acquainted with some engineer who uses an indicator and watch the operations of applying it to a steam engine. If you can get the opportunity of applying the indicator yourself, it will be all the better.

(92) ——, Chicago, writes:

I have been running a Rogers simple piston valve engine and have been troubled with a bad blow in left cylinder, which I laid to the packing, as it sounded only when engine passed forward and backward centers. The sound is like a sharp whistle. The packing was examined and found to be all right. What do you think causes the blow? A.—We think it is probably caused by the piston valve bushing being worn near the ends. If any of our readers can offer a better explanation, we should like to hear from them.

(93) L. B. F., Wilmington, Del., writes:

I have several times lately read the expression "horse-power of boilers." Now, I cannot make out how a boiler horse-power could be computed. A locomotive boiler, with its sharp artificial draft, will make ten times the steam made by a stationary boiler of the same grate and heating surface. Several of your readers would like to have light thrown upon this obscure question. A.—A boiler horse-power was established by an engineering committee connected with the Centennial Exposition of 1876, and it was the capacity to evaporate 30 pounds of water at 100 degrees Fahr. into steam of 70 pounds pressure. This is equivalent to evaporating 34.5 pounds of water into steam at atmospheric pressure.

(94) Apprentice Boy, Nashville, Tenn., writes:

I notice in LOCOMOTIVE ENGINEERING and in other papers occasional references to perpetual motion and to perpetual-motion machines. Will you please define perpetual motion and describe a perpetual-motion machine? A.—Perpetual motion is not a fact, but a dream or hopeful fallacy which has been entertained by many visionaries who did not understand the immutable laws of the universe. They supposed that a machine could be made to supply its own motive forces independently of any action or force from without, and that it would keep on running until the parts were worn out. Many machines have been made for this purpose, but they have always proved failures, and always will fail, as long as gravity and friction exist.

(95) V. H. C., St. Joseph, Mo., writes:

One day a Rhode Island mogul was going along pulling a train, and the water in the glass was quite clear. A sudden stop had to be made for orders, and when the engine started, the water in the glass was as black as ink. It was blown out of the glass several times, but it did not get clear again till about ten miles had been run. Please explain the cause. A.—It is difficult for a man sitting in a New York office to tell what caused the boiler water to become black, without more particulars than those given. But we think that a deposit of black substance had settled upon the firebox crown and that the sudden stop left the crown bare long enough for the heat to release the stuff that blackened the water. If any of our readers can give a better explanation, we should like to hear from them.

(96) W. P., Allegheny, Pa., writes:

I listened some time ago to a learned man talking about the locomotive, and he said that a strange thing about the development of the locomotive is that no one knows who were the inventors of several of the most important attachments of this form of steam engine. He mentioned among the articles whose inventors are unknown, the "D" slide valve, the blast pipe, the link motion and the steam whistle. Was his statement correct? A.—No. The inventors of all those parts are well known to history. The "D" slide valve was invented by Matthew Murray, of Leeds, England; the blast pipe in the chimney of a locomotive was first used by William Hedley, who built the first practicable locomotive, which is now in the South Kensington Museum, London, and is called "The Puffing Billy"; the link motion was invented by William Howe, a pattern-maker in the Stephenson Locomotive Works, Newcastle, England; the steam whistle was invented by Adrien Stevens, Merthyr, Wales. The first steam whistle was made from a piece of organ pipe, brought from London by a friend of the inventor. The sound of an organ pipe suggested the idea of inventing the steam whistle.

Pooling Increases Hot Box Trouble.

The pooling or chain-ganging system of crews on locomotives will never be popular with the engineer and firemen. A speaker in the Traveling Engineers' convention last month in Cleveland, in discussing the hot-box question, said that he believed the return to the old system of having regular crews on engines would do away almost entirely with the heating of hot boxes, hubs and pins on locomotives, for the reason that no engineer can be expected to take the interest in anybody's engine that he would in his own. He claimed further that the dirt and neglected condition of the engine had much to do with the personal interest and appearance of the engineer, and in closing said, "You put a man in a hog-pen and keep him there; he will lose all his self-respect, and you will thereby lose a man and get a hog."

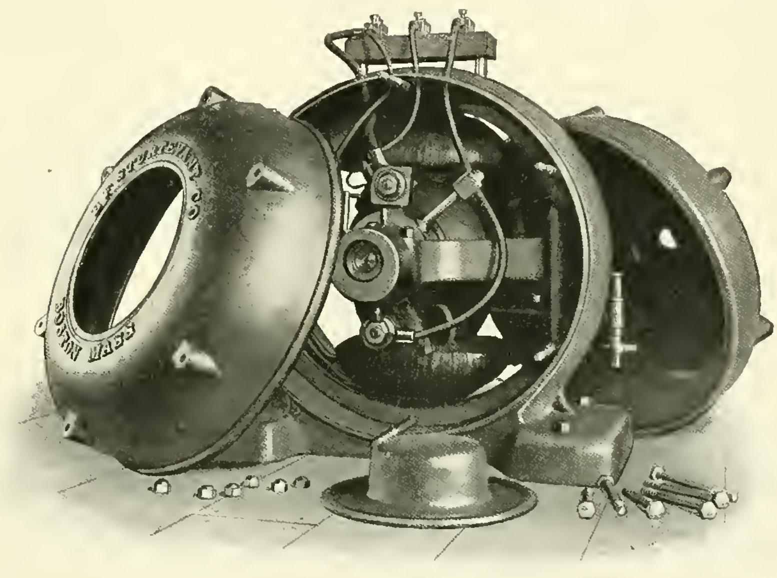
A New Type of Enclosed Electric Motor.

This type of motor, built by the B. F. Sturtevant Company, of Boston, Mass., being enclosed and readily portable, in the small and medium sizes, is specially adapted for driving small machines, such as machine tools, blowers, etc. For certain classes of work where the conditions are favorable, the motor may be direct-connected to the machine which is to be driven. Cased fans of the centrifugal type may be thus equipped, and if desired the fan-casing itself may be supported by the motor frame and made adjustable about it, so that any direction of air discharged may be provided.

In order to avoid the excessive temperature which is incident to the operation of most enclosed motors, this type has been very carefully designed, so that a low temperature rise can be maintained without greatly increasing the size and weight above that of the ordinary open type.

This machine is capable of continuous operation for ten hours, with a maximum temperature rise not exceeding 60 degrees Fahr. Yokes extending out from the field ring support the armature shaft. The end casings are entirely independent and can be instantly removed to give access to the entire interior. The bearings and brushes can be reached by simply removing the caps in the center of the casings.

The brushes are of hard carbon, in holders of a modified reaction type, which allows of easy adjustment when it becomes necessary to reverse the direction of rotation of the motor. The bearings are self-oiling and self-aligning, and fitted with composition sleeves, which are removable from the outer ends of the boxes. These motors are built in this type in seven sizes ranging from 1-5 to 5 horse-power.



NEW STURTEVANT ENCLOSED MOTOR.

Nickel Steel Rails on the Pennsylvania

Early last year the Pennsylvania Railroad people, who are always looking for improvements in railroad appliances, placed an order with the Carnegie Steel Company for 300 tons of steel rails, to contain 3 per cent. of nickel. Nickel steel had proved so reliable and enduring in other lines of engineering that its use in rails seemed to be very well worth a trial. The rails are 100 pounds to the yard, and were made by the Bessemer process. The material proved very difficult to work with the ordinary tools used on drilling and straightening rails, and it was so difficult to roll that only 220 tons of No. 1 and 57 tons of No. 2 rails were made. They were all placed on the west track of the horse-shoe curve about a year ago. They are said to be wearing so well that it may pay to use nickel-steel rails where the traffic is hard upon the track.

How Coal Was First Discovered in Kansas.

When Kansas was first settled, the railroad facilities were poor as well as limited to very small districts in this great State; so that the supply of coal for fuel was nowhere equal to the demand. Then its price at the railroad stations, with teaming to their homes, made the cost of coal for domestic use prohibitive.

Corn, on the other hand, was plentiful and very cheap. It made a nice hot fire, and cost less in proportion to its heating properties than coal; so corn was frequently used for fuel.

The fact that corn was used goes to show that the farmers did not know anything of the coal beds which were only a few feet below the surface of the soil where the corn grew.

One settler, of more enterprise than his neighbors, longed for a cellar under his house; so when he got ready to build a new home, Eastern fashion, he dug a cellar first, and lo! before he got deep enough for his cellar, a bed of very good coal was struck. The news soon spread around of the store of fuel so near at hand, and we will venture the assertion that with a cellar full of coal, no more corn was used for fuel.

Electricity is King.

London's new electric underground railroad has so facilitated travel in that city as to cause an appreciable falling off in the receipts of the old system of omnibuses. Persons are now moved quickly about, and the 'buses are obliged to bow in submission to the trolley car. The restaurants in the vicinity of the Stock Exchange are also sufferers by the introduction of rapid transit; for many brokers who were obliged to lunch in nearby restaurants now find it possible to reach the fashionable West End restaurants in the lunch hour. Beast succeeded man as a bearer of burden; then came steam, and now the electric motor seems to have triumphed over all these, and ere long will doubtless hold undisputed sway.

Small Boy Attempts to Produce Fireworks.

Joe Kelley, a ten-year-old New Yorker, was arrested the other day and charged with trying to put the Third avenue underground trolley road out of business. An inspector, or track walker, found the boy trying to force an iron horseshoe through the trolley slot near Fourteenth street, and quickly handed him over to a big policeman. Joe was hustled to the police station, where he sobbed out his troubles. Someone had told him that if he would drop a piece of iron in the trolley slot, he would see more fireworks in a minute than he would see in a week at Manhattan Beach. Thus assured, Joe proceeded to produce a gigantic display of Roman candles, sky-rockets and pin-wheels at a small cost. He found a horseshoe and was poking it through the trolley slot when caught. The pyrotechnic display didn't come off, but Joe was fined $5 for the attempt.

Specialized Memory.

The specialty of memory which is so often witnessed in large hotels and clubs where the man in charge of hats at the dining-room door hands every man his own hat, is developed in a wonderful degree by some of the men whose duty it is to register the names and numbers of cars entering junction points. In this regard, a well-known railroad man told the following story the other day: "When I was at Mandan, N. D., we had a man whose memory of car numbers was really remarkable. When a train whistled into the yard he would step to the platform, and, without a book or pencil, would stand and watch the cars go by. If anyone was standing near he would converse upon whatever subject occurred, and when the conversation was ended he would step into his office and make a complete and accurate record of the train, beginning at the first car and ending with the caboose. Sometimes, just to test him, we would get him to begin at the caboose and write the numbers the other way, or else begin in the middle of the train and work both ways. He never made a mistake that I remember. Car numbers, the names of the roads to which they belonged and their relative position in the train would all be recorded accurately. His was the most remarkable memory that I ever knew of."

Schenectady Locomotives on the Vandalia Line.

Mr. W. C. Arp, superintendent of motive power of the Vandalia Line, has written to the Schenectady Locomotive Works:

"I thought it would be interesting to you to give you the performance of engine No. 177. This engine was delivered to us in March; went into service on the 23d of the same month, and was in continuous service up until the month of August this year, making a total mileage of 165,013 miles without being taken into the shop for classified repairs. Had it not been that the engine was in an accident we feel safe in saying that it would have made 200,000 miles. During this time the engine lost twenty-nine trips."

The engine No. 177 referred to in Mr. Arp's letter is one of four 20 x 26-inch eight-wheel passenger locomotives which the Schenectady Locomotive Works built for the Vandalia Line, March, 1899. The following are the general dimensions of the engines: Cylinders, 20 x 26 inches. Driving wheels, 78 inches diameter. Boiler steam pressure, 190 pounds. Heating surface—Tubes, 2,066 square feet; firebox, 175 square feet; total, 2,241 square feet. Grate surface, 30 square feet. Weight on drivers, 85,800 pounds. Total weight, 132,300 pounds.

Precocious Youngsters Turn Wreckers

Two nine-year-old Colorado boys were recently arrested and charged with two attempts at train-wrecking. Their first attempt was successful. They turned a switch and sent the Midland Terminal passenger train crashing into some freight cars on the siding a half mile east of Independence. Two passengers were injured and about $40,000 worth of property destroyed. The youngsters' second attempt was on the Florence and Cripple Creek train in the Independence yards. They were detected and captured while preparing for the wreck. When apprehended they gave as their excuse that they wanted to see a real big railroad wreck.

At their annual meeting last month the shareholders of the Chicago & Grand Trunk Railway determined to spend $4,000,000 in putting that property in first-class shape, so that it will be able to earn something for the shareholders. The road will be strengthened in every way possible. New steel rails are to be laid, and in some places the roadbed will be reconstructed. Modern equipment of a high standard of excellence is to be purchased, and the stations, freight yards and terminal facilities are to be modernized and extended. In order to raise the money needed for these improvements there will be an increased issue of bonds.

The regular monthly meeting of the Northwest Railway Club was held in the parlors of the West Hotel, Minneapolis, Tuesday evening, October 9th. The following papers were read: "The Traveling Engineer," by Mr. Geo. H. Horton, and "Repairs to Private Line Cars," by Mr. Geo. P. Zachritz. An interesting discussion was held on Mr. Horton's paper, also on "The Wear of Locomotive Driving Wheel Tires," but owing to the lateness of the hour the latter subject, together with the discussion on Mr. Zachritz's paper, was carried over to the next meeting. President E. A. Williams presided, and there was an unsually large attendance.

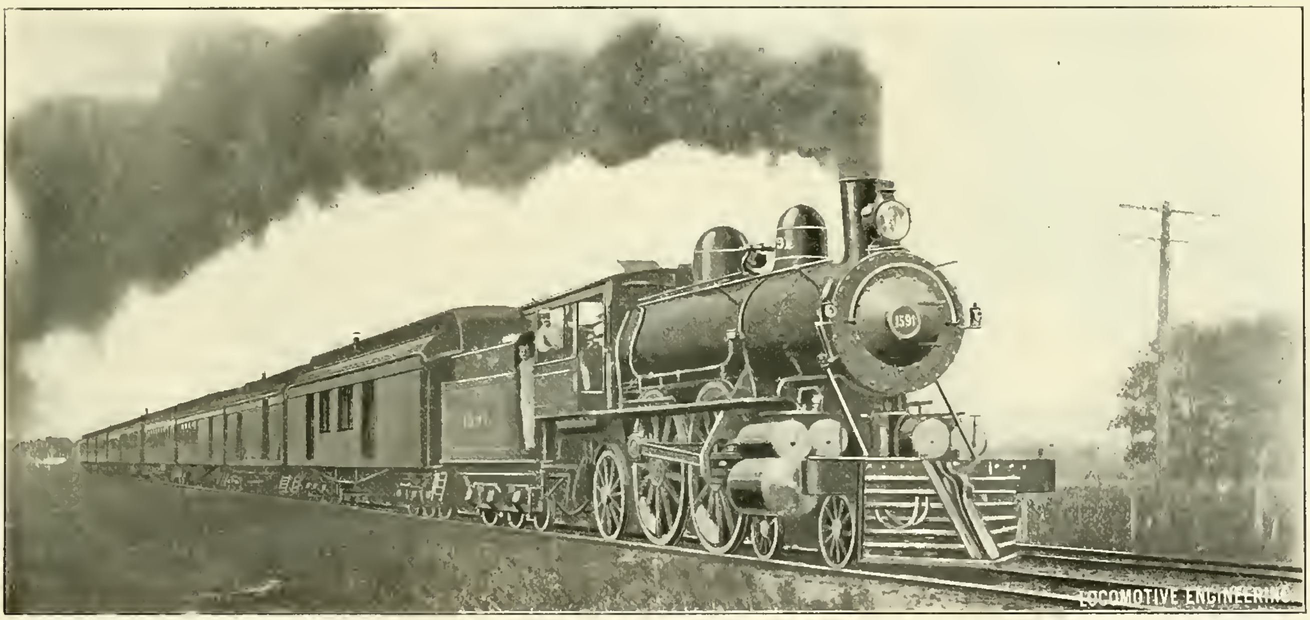
Free Baggage Car for Theatrical Companies.

Theatrical companies generally want, and get, their full money's worth when traveling by railroad, and their patronage is not always sought, nor is it the most lucrative. Still, they are a considerable item in the passenger agent's schemes. The Western Passenger Association has just ruled that a company must have a party of twenty-five persons before it will be given a baggage car free of cost.

Photographing Fast Trains.

As anyone who has tried it knows, it isn't an easy task to photograph a fast train and get good results. You may get a blurred streak of something which you can point to as the train, but it's a good deal more interesting to you than to your friends. Our friend Mr. F. W. Blauvelt has been remarkably successful in this work, as the readers of Locomotive Engineering know from the photographs he has sent us. He has, however, depended entirely on his skill to catch the train at the right moment, and it is very difficult to do this.

Mr. Allen A. Green, of Chicago, has called electricity to his aid, and makes the train do the exposing by closing the circuit which operates the shutter. This contact he places about 6 feet behind the position determined on for the picture, so as to allow time for the shutter to work, and the result is shown in the accompanying illustration.



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THE BURLINGTON'S NO. 1.

Different Kinds of Ability.

We listened a short time ago to two master mechanics discussing the methods they followed of promoting their workmen to higher positions. One said: "I always give the most skilful man the preference. When my foremen consult me about promoting a man to be a gang boss, I say, 'Set up the man who can do the best job.' The foremen have protested at times against taking the best machinist out of the toolroom to put him in charge of a pit; but I say that it is only fair that the best man should have the preference and that promotion is the only reward we can give a man for acquiring more manipulative skill than the other workmen. Besides, he knows that a job is properly done, and inferior workmen are kept up to the scratch. When I want a traveling engineer, I take the engineer who has made the best record for keeping time and for avoiding blunders."

The other master mechanic told that he liked to promote skilful men, but there were considerations which he regarded of much greater importance in a foreman or gang boss than hand skill. "My policy," he said, "is to select men who have the faculty of getting along well with others and who display signs of having the turn for managing things. The man in a little authority who drives and bullies those under him is not a profitable man for his employers. He may make believe that he is making things hum, as the saying is, but the quiet leader who pays close attention to what the men are doing, the foreman who is careful to see that another job is ready when one is finished, is the person who turns out the most work. If I have to choose between a very skilful man who has displayed no executive ability and an inferior mechanic who has the faculty of managing men, I choose the latter every time."

This conversation sent us mentally in search of examples, and we found a fairly representative case. There were at one time in a manufacturing establishment two foremen—one was named Brown; the other Wilson. Brown seemed to be a slow-going man with no superfluous education to brag about; but he was always looking ahead. As soon as orders came in for a set of machines he began ordering the parts that would be first needed, and then the parts for each succeeding operation were ordered in the order they would be called for.

Wilson was a well-educated man, an excellent mechanic and a rusher. It was torture for him to pass a job that was not so well done as he would have done it himself, and he was constantly taking the tools out of men's hands to show them how to do work. When orders for a set of machines came in, he would send directions to the different shops to have the parts turned out; but when he began the fitting up of the machines he would find parts wanting that belonged to the first operations and parts ready that would not be wanted for days. By personal push and energy he tried to turn out the machines as quickly as the other foreman did; but he never succeeded, simply because he lacked executive ability—as the men said, he never could see beyond his nose. His native energy made him popular with his employers for years; but energy in the long run falls behind good management.

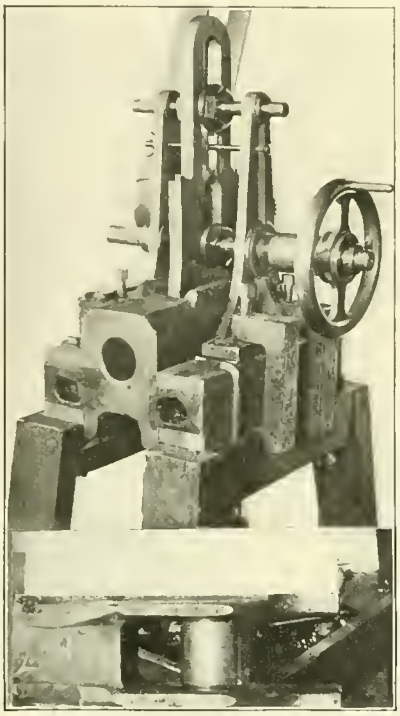
By plodding steadily along, watching every point and keeping his men steadily at work, Brown moved forward, until he is now general manager of the works. Wilson works in the drawing office, and feels aggrieved because his friend Brown does not make him chief draftsman.

Similar experiences are met with in every line of business. Manipulative skill, distinguished ability in executing details, surpassing mathematic or inventive genius are seldom found in combination with executive ability. The skill, the working out of details, mathematics and invention call for a great amount of concentration; executive management requires a wide, far-seeing mental scope. Ability for working out details and executive ability are sometimes combined in one man; but very rarely. We meet occasionally with men who possess a combination of different excellent qualifications, such as the grasp of details and the faculty for business management. When to these are added energy and industry, that man is certain to be successful beyond his rivals. But these elements of excellence are born with a man. Labor and hard work may develop the natural turn for business, but they cannot create it.

Wallace Crosshead Pin Turner.

The turning of solid crosshead pins is always quite a job, unless you are rigged up for it, but the cut shows a neat little machine for doing this work. This is known as the Wallace crosshead pin turning machine, and is made by the Fisher Governor Company, Marshalltown, Iowa.

The cut gives a very good idea of the machine, and the time taken on the crosshead shown below the machine—two hours —is certainly quick enough to satisfy the most hustling foreman in the shop. Details can be obtained from the makers.



WALLACE CROSSHEAD TURNER.

Fight of the Clan.

Chicago was the Mecca for the ticket scalpers during the recent Grand Army encampment in that city. Several thousand excursion tickets were sold at reduced rates, and as the return portions were good for several days, the scalpers reasoned that many would be thrown on the market. Sufficient profit was seen in the traffic bound to follow that over a hundred out-of-town scalpers flocked to Chicago. The local ticket brokers resented this action, which they characterized as an "unwarranted invasion," and endeavored to suppress the foreigners. The invaders, however, were more or less successful in capturing the return halves of tickets surrendered by the army men.

The Irony of Fate.

Late one February afternoon a group of railroad officials were standing within the shelter of the roundhouse of a well-known Western town, watching the employés go to and fro, the snow and sleet swirling and blustering them along with a bitter blast.

Among the group was the shop foreman, who seemed to be giving the officials a brief sketch of the different men passing before them.

The engine for the evening passenger train was being taken out, when a noticeable man with a stern, set face came striding up. His face was kind in spite of his stern look, yet with the stamp of some scathing ordeal passed through and endured because endurance was the only thing possible. He walked up to the foreman, and with a brief though courteous salutation to the surrounding spectators, made his business known. "The Caller tells me that West's child is in a dying condition, and I, to-night, am the only engineer who can run in his stead." The foreman seemed thunderstruck and was about to give voice to his surprise, but was cut short by the look of agony in the other man's eyes, although not a muscle of his face moved as he said, "Do not be afraid for me; I can manage the train, and common humanity demands that West remain with his wife to-night." The personality of the man, Freeman by name, had caused an unusual stir of interest among the officials, who began to question the foreman as to his history. Telling them to meet him at the Y. M. C. A. later in the evening, the foreman went to attend to his duties. The storm had delayed the eastbound train so that it was nearly an hour later than the scheduled time when the west-bound passenger pulled out.

EFFECTS OF A WASH-OUT.

During this delay Freeman had been up town ordering various necessities sent to the ailing child, whose parents were poor. When he mounted his engine, it was without giving his usual close, keen survey to every part.

That night in the reading room of the Y. M. C. A. building, the foreman told the story that was traced on Will Freeman's face.

"Seventeen years ago," he began, "Freeman came to me, a boy of nineteen, and asked for honest work. He began sweeping the shops, and he swept them right. From that he became gang-boss of the laborers, then fireman, and now he is one of our most capable and trustworthy engineers on the road. When about twenty-five he became acquainted and fell in love with Nell Haughton, an animated brunette, accomplished and beautiful, the daughter of a retired railroad man who owns a pretty bit of Kentucky's blue grass between here and Louisville. Miss Haughton was at first perfectly indifferent to Freeman, for only the preceding year her father had forbidden her further acquaintance with Lee Mayrard, a worthless scamp of a dentist, who used to practice in this city, and who did not bear a strictly honorable name. Miss Haughton, while really caring for the scamp, obeyed her father and held no communication whatever with him, except on her visits to friends either here or at Louisville, when he always contrived to see if not speak to her. This went on for more than two years, when Freeman, after many discouragements, finally obtained Nell's consent, and they were married.

"All went well for five years, during which time two boys were born, and Mrs. Freeman, if not quite happy, was content, and Freeman in his contained way was in a perfect state of bliss. His wife and children stayed with her father, and on fine evenings it was a pleasant sight to see the three come down to the gate at the crossing on her father's place, to wave to Freeman as his engine passed.

"Maynard had wound up his business affairs and vanished a few days after the marriage, and we never heard from him in any way until six years later, when he suddenly returned and opened his office at the old stand and obtained a fairly good practice. Just how he contrived to obtain the first interview with Mrs. Freeman is not known, but it came out afterwards that they met several times in this town and once at Louisville.

"On the 13th of February a year ago, I went to Louisville on the evening passenger, riding on the engine with Freeman. as we passed the home crossing, as the one on the Haughton place is called, Mrs. Freeman and the boys waved their usual greetings. The night was gray and cloudy, 'threatening snow,' as Freeman remarked while we dashed along. By next evening the ground was covered with the snow, which was still falling, driven by a biting wind. As the crossings were neared, the crossing signal was blown repeatedly, more especially on account of the drifting wind and snow. The Home Crossing is on the further side of the sharpest curve on that part of the road, and the increased whistling which now followed only served to further frighten a horse pulling an open buggy, in which were a man and woman. The horse dashed right forward, and standing by Freeman I saw his face blanch with an awful look, as he uttered a sharp, low cry. When the train was stopped and I, followed by several passengers, hurried back to the crossing, we found the mutilated bodies of a man and woman, now dead. One glance explained the engineer's agonized cry—the man and woman were Maynard and Nell Freeman. Their bodies were placed in the caboose and I returned to the engine, from which Freeman had never stirred. On seeing me he looked up and asked in a hard voice, 'Is she quite dead?' 'Quite,' I answered. 'I knew her before the engine struck the buggy,' were his only other words.

"He left the train at Louisville and drove out to break the news to his father-in-law. There he found a note from his wife, telling him that she had never ceased to care for Maynard—that they had decided to leave the country together. She made no excuse, asked for no forgiveness—did not seek to palliate her sin in any way; she simply stated the bare, cruel facts and signed the paper, 'Nell.'

"Mr. Haughton attended to the details of her funeral, Maynard's remains being sent to his lawyer in his native town, and the talk and excitement caused by the occurrence lulled. Freeman forbade the mention of his wife's name in his presence. Mr. Haughton's widowed sister came to keep house for him and bring up the children, whose father steadily refused to see them, merely stipulating that when old enough to judge fairly the story of their mother's treachery be told to them gently and plainly, so that no outsider might suddenly confront them with the disgraceful truth.

"Freeman came back to work in a few weeks, only asking for an Eastern run instead of a Western, and he has never been west from this town again until to-night."

Next morning an additional pathos had been added to the tragedy of Freeman's life. It was told by the man who had fired for him on the previous night. Being already behind time, they had made every possible minute. On approaching the Home Crossing Freeman had almost unconsciously slackened down from the somewhat reckless speed at which he was going, keeping, at the same time a sharp lookout in front, and while doing so had noticed a whitish shape on the pilot. At first he thought it was some reflection of the headlight, but, certain that he saw a movement, he called the attention of his firemen to it. Upon the man declaring it to be a living creature and no shadow, the engine was stopped and both went forward to investigate. Judge of Freeman's feelings when he found his own two children crouched on the iron frame, the younger fast asleep, tightly held by his brother, who greeted Freeman with shouts of joy. They were taken on the engine, and the eldest, Jan, the living image of his mother, told the following: Their grandfather had brought them to town that morning, and in the afternoon had left them at the hotel in charge of one of the waiters, while he himself attended to some business matters. The boys, who had never ceased to ask for Freeman, escaped from the not too vigilant eye of their temporary guard, and started off to search for their father. Reaching the station they had no difficulty in finding his engine by the well-known number. It was easy in the gathering dusk to climb on the "cowcatcher."

Freeman has gone back to his wife's old home, and if sometimes his thoughts are almost too bitter for the endurance of this mortal clay, he can only cling to the shadowy hope of a meeting "where they neither marry nor are given in marriage" —a hope!—wavering, flaring, flickering, that lasts in every human soul until "all the dull, deep pain and constant anguish of patience" are done with, and "our weary feet have completed their journey."

QUEENNIE WILKIE.

A despatch from Monterey, Mexico, says the Department of State at Washington has succeeded in securing the release from the State Penitentiary there of H. E. Gaulding, an American trainman, who was tried in the Mexican court several months ago and sentenced to eight years' imprisonment for the crime of throwing a Mexican tramp off a train. Gaulding was employed on the Mexican International, and his arrest and conviction caused his American friends to appeal to the United States Consul here, who laid the matter before the Department at Washington. Gaulding says that he was well treated by the prison authorities.

Overworked firemen will find Hoffman's infallible United States metal polish a great saving of labor. Two units of energy employed in rubbing tarnished bright work with the Hoffman paste will effect as good results as five units of energy expended upon any other polishing mixture. Send to 295 East Washington street, Indianapolis, Ind., for sample.

The Goheen Manufacturing Company, Canton, O., have lately received very complimentary letters from railroad officials about the value of their carbonizing coating for the preservation of structural work and railroad machinery generally, including steel ore cars.

Manning, Maxwell & Moore's Latest Catalogue.

About six years ago Manning, Maxwell & Moore, of Liberty street, New York, published a large, illustrated catalogue showing a most complete line of railway, steamship, machinists' and contractors' tools, which formed a wonderfully useful work of reference for those connected with the purchase of tools. The business of the firm named has increased so much since that catalogue was published that they have had to issue a separate catalogue devoted to metal and wood-working machine tools and their appliances. The work fills nearly 700 pages of what is called imperial quarto (13 x 9¾ inches), and every page contains one or more excellent engravings, that are the best kind of graphic description of the tools. We found the other catalogue the best reference concerning machine tools that we know of, and this new one is certain to prove even more useful than the other. Purchasing agents, superintendents of motive power, master mechanics, master car builders and general foremen will find it very profitable and edifying to make this catalogue not only a work of reference, but a book to study. A few hours a week spent digesting the pages of this work will post a man thoroughly concerning the best tools upon the market. We frequently hear general foremen and master mechanics express regret that they have no opportunity of making themselves familiar with the most improved forms of machine tools and woodworking machinery. Here is a book that gives as much information as could be gained from a visit to the Paris Exposition.

A valuable feature about this catalogue is that it is not confined to the tools handled by Manning, Maxwell & Moore. It contains illustrations and descriptions of every tool upon the market which is worth purchasing.

An interesting study in methods of publicity and promotion is presented by the progress of the B. F. Sturtevant Company, of Boston, Mass., during the past few years. This company, devoting itself principally to the manufacture of blowers, has gradually evolved many special types designed for specific uses. It has not been deemed sufficient to merely advertise these types, but exhaustive study has been made of the conditions and best methods of application, special treatises have been prepared upon these subjects, purely educational articles regarding them have appeared in the technical press, and special illustrated lectures have been delivered before technical schools and societies. Some of these lectures, devoid of all reference to the B. F. Sturtevant Company, have been published for free distribution with gratifying results. Among recent publications are lectures by Walter B. Snow, of the engineering staff, entitled, "The Influence of Mechanical Draft upon the Ultimate Efficiency of Steam Boilers," "Mechanical Ventilation and Heating by a Forced Circulation of Warm Air" and "The Application of Mechanical Draft to Stationary Boilers." Any one of these publications will be sent upon request.

Free Scholarships.

The trustees of the American School of Correspondence, 156 Tremont street, Boston, Mass., have decided on a new policy to promote their school work. Believing that a personal exposition of the advantages of a school is a great help to printers' ink, they are announcing in their advertising their willingness to grant a limited number of free scholarships to men in various large establishments and parts of the country. We are not advised as to the exact conditions, but anyone who thinks he would like to have one is invited to correspond with them, giving his occupation, and his application will receive consideration by the trustees.

The school calls attention to its courses in mechanical and electrical engineering (including a complete course in mechanical drawing), the former including steam, locomotive and marine engineering. Its work is entirely confined to these branches, and does not extend to commercial or artistic lines.

New Location for the Third Rail.

The dangerous character of the third-rail system as used by the electric lines on the Brooklyn Elevated structure, has prompted the city authorities to take steps to have the location of the third-rail changed. Instead of laying it on the ends of the ties, as at present, it is proposed to place it somewhere between the tracks and below protecting boards, where persons crossing the tracks may not be able to come in contact with it.

Record Year for New Locomotives Was 1899.

During the year 1899 the locomotive builders of the United States furnished to the railroads 2,475 new locomotives. This breaks all previous records for locomotive building, the next year being 1890, when 2,250 engines were put out. If all the 1899 engines—those built by locomotive works and those by the railroads in their own shops—were coupled together on a single line of straight track, they would reach nearly 30 miles.

The Berlin firm of L. Borsig, the largest German manufacturers of locomotives, of which it has turned out 100,000 in its history, has just completed its first locomotive built on an American pattern with American tools and under an American superintendent. Heretofore Germany has been unable to compete with the American locomotives in Russia.

Baggage Men Complain.

For some time past baggage men have complained of the heavy and cumbersome trunks, crates and boxes checked as baggage. Nowadays commercial travelers, minor theatrical agents and others check almost anything of almost any weight as baggage. So general has this practice become that the baggage men have sought relief from what they consider an imposition upon themselves and the railway companies, claiming that extra baggage cars for carrying the baggage and electric cranes and pneumatic jacks for unloading will be necessary if the nuisance is permitted to continue.

The Buffalo, Rochester & Pittsburgh Railroad have just received some very large twelve-wheel freight engines from the Brooks Locomotive Works. The cylinders are 20 x 26 inches, 48-inch wheel centers, 210 pounds steam. Two pairs of drivers are under the firebox, which is 120 inches long by 42 inches wide. The engines weigh something near 170,000 pounds, and so far have done very good work. This company are getting ready to put new shops at Dubois, Pa., at which the heavy repairs for the whole road will be done. These new shops are to be modern and up to date with all new machinery, leaving that at the other shops for division repairs.

One of the most beautiful illustrated tool catalogues which ever came to this office was lately received from the Chicago Pneumatic Tool Company. It is of standard middle size and consists of ninety-six pages, nearly every one of which is filled with the finest engravings we have ever examined. The most of them illustrate the operations by the Boyer tools on iron and steel, but others show how the artistic work of carving marble and similar material has been facilitated by these tools. Mention is made that the Chicago Pneumatic Tool Company's tools took the gold medal at the Paris Exposition. We think that the catalogue under notice would have taken the Grand Prix, had it been exhibited in competition with all others.

Some Large Boilers.

The Atchison, Topeka & Santa Fé Railroad Company are building at their Topeka shops, ten pushing engines for use in mountain service, most of them to be used on or near the Pacific coast.

The boilers for these engines, one of which is finished, are 84 inches in diameter at the smallest ring, of 15-16 inch steel; each ring of the shell is composed of a single sheet with butt joint, sextuple riveted, with 1-inch rivets.

All flanges are 1-inch steel. The fireboxes are 10 feet 6 inches long by 40 inches wide, with 3/8-inch side sheets and 1/2-inch flue sheets. The crown sheet is supported by crown bars, the dome is located over the middle of the boiler. There are 365 2-inch flues, 13 feet 10 inches long. The working pressure will be 225 pounds.

When they are complete locomotives they will be 21 x 32 inch simple consolidations.

The boilers weigh 71,450 pounds empty and hold about 3,600 gallons of water in working order.

A new use has been found for the sand blast which is now being used for so many industrial purposes. At the Columbus shops of the Panhandle they have rigged up a sand-blast car to be used for cleaning bridges before they are repainted. The contrivance consists of a flat car with an engine and boiler and an air compressor. Before bridges can be repainted it is necessary to clean the iron and steel work, and this is a slow and worrisome as well as an expensive task when it has to be performed by hand. With the air compressor and the sand, the work can be done quickly and economically. A hose attached to the air compressor will turn the sand blast on any part of the bridge or building where it may be required.

Be Merciful to the Fireman.

President Stack, in his address at the opening of the Traveling Engineers' convention at Cleveland, suggested that the boiler head of the large modern locomotive be lagged in order that it might be made more comfortable for the fireman in summer time, as the radiation of heat from this large, bare surface could not but have an enervating effect on the fireman, who is already called upon to exert all his strength in keeping up steam on these monster locomotives.

PERSONAL.

Mr. S. S. Morris has been appointed trainmaster of the Chicago & Alton at Bloomington, Ill., vice Mr. A. A. McGregor, transferred.

Mr. Leonard Goodwin has been appointed general superintendent of the Lehigh & New England at Pen Argyl, Pa., succeeding Mr. W. J. Young, resigned.

Mr. F. M. Dean has been appointed assistant master mechanic of the Chicago, St. Paul, Minneapolis & Omaha at Sioux City, Ia., succeeding Mr. Thomas Burns, resigned.

Mr. E. A. Austin, trainmaster of the Atchison, Topeka & Santa Fé at Wellington, has been transferred to the Oklahoma division at Arkansas City, Ark., and is succeeded at Wellington by Mr. G. Hetherington.

Mr. G. H. Olmstead, trainmaster of the Oregon Short Line at Lima, Mont., has been promoted to the position of acting superintendent of the Montana division at Pocatello, Idaho, in place of Mr. L. Malloy, who has been granted an indefinite leave of absence on account of ill health.

The Song of the Headlight.

When the full moon lays a radiant haze
From earth to heaven's wall,
Or the tranquil stars mark the viewless bars
Whence the arrows of vision fall—
Or I send my glance where the quick drops dance
With the pattering call of the rain,
To their comrades asleep in the hidden deep
Of the subterranean main,
Or if storms are out, and the free winds shout
With fitful falls and swells,
A steadfast glow of light I throw
On my gleaming parallels.

I guide the train o'er the level plain,
A swiftly nearing star,
And I bend and swerve where the mountains curve
My iron-bound path to bar;
Up their rocky steeps the fleet flame leaps,
Or I flash in their depths below,
Till the mosses that dress each dim recess
And the nodding ferns I show;
I spring to illume the frowning gloom
Of precipices gray,
And waters smile from the deep defile,
In my momentary day.

Where the wood benign, with beck and sign,
Invites all timid things
To its shelter spread for the crouching head,
And its covert for drooping wings,
I bear my light, till in vain affright
The doe with her trembling fawn
And the creatures meek that refuge seek
In the forest shade withdrawn,
Press closer yet to the copse dew-wet,
Or speed through the whispering grass,
To hide them away from the searching ray
I shoot through the dark as I pass.

As a meteor flies in star-set skies
By a myriad moveless spheres,
I hurry along where the lamp-lights throng
As the sleeping town appears;
Like the coming of Fate, to those who wait
Till I bear their love away,
I seem as I shine down the narrowing line,
Ere I pause for a moment's stay;
But he who feels those rolling wheels
Lead home, to his heart's desire,
Can half believe his eyes perceive
The prophet's chariot of fire.

Still on and on till the night is gone
I follow the vibrant rails,
Till the east is red, and overhead
The star of the morning pales;
As foes may fear the soldier's spear,
But comrades have no dread,
The lances of light I hurled at the night
Pierce not where sunbeams spread,
So I cease my rays when the heaven ablaze
Proclaims the darkness fled.

A new explosive has been discovered which gave considerable trouble to one railroad company. A harmless-looking keg was placed in the baggage car of a train going out of Pittsburgh one day lately, and the train had not gone far when a violent explosion took place, which did a great deal of damage to the contents of the car and nearly killed the express messenger. It turned out to be a keg filled with brewer's yeast. As it had been charged at high pressure and low temperature, the high temperature in the car expanded the mixture so much that an explosion followed.

The "almighty dollar" is chased a little too hard by American business men, according to the preface to Finley Acker's "Pen Sketches." He argues that a man can do a year's work better in eight or ten months, with proper recreation, than in twelve months without the recreation. He thinks one of the best forms of recreation is foreign travel, and he whets the appetite of the reader by tramping him through "The Streets of Cairo," showing him the "Sphinx and Pyramids," inviting him to a "Bedouin Wedding Festival," pointing out the peculiarities of "Modern Jerusalem," selling him souvenirs in the "Bazaars of Damascus," serenading him in the "Canals of Venice," treating him to a spectacular performance in the "Roman Colosseum," and, finally, walking him through the silent streets of "Pompeii," and then rushing him up the steep sides of "Vesuvius." The price of this entertaining little booklet is 50 cents; illustrated with over one hundred pen drawings.

Immense Electric Transmission Plant.

It is reported in San Francisco that the largest electric transmission plant in the world is now being rushed to completion near that city. Fifteen hundred men are now working on a project whereby the water from the mountain lakes and streams is to be utilized to furnish lectric power to the cities of San Francisco, Oakland, Sacramento and other California cities. The voltage will be 60,000, so it is reported, and 180 miles of transmission wire will conduct 14,000 horse-power from the generators to the users.

At some date prior to 200 B. C., we are told by Hero of Alexandria that an ingenious mathematician invented a steam turbine. That is a long time ago, and it is only now that the steam turbine is receiving its long-delayed opportunity. It is only since the advent of the electric dynamo that engineers and inventors began to appreciate the possibilities of the steam turbine as a prime mover. To-day steam turbines developed by Mr. Charles A. Parsons are driving a British torpedo destroyer at speeds over 40 miles on hour. That invention makes it probable that the ocean will yet be crossed at a speed of 40 miles an hour.

BOOK NOTICE.

"The Postage Manual." Compiled by L. S. Elmer. Published by George F. Lasher, 151 North Tenth street, Philadelphia. 25 cents.

This is the handiest little postal guide we have seen. It is small, compact, and so arranged that it is an easy matter to find any information you want. Everything is arranged alphabetically, and covers all the points ordinary mortals need.

Bethlehem forgings have again scored in the remarkable results attained in the trial trips of the United States battleship "Wisconsin" and Russian cruiser "Variag." The "Wisconsin's" shafts were forged from fluid-compressed nickel steel, and those for the "Variag" from fluid-compressed carbon steel, were all shaped under the hydraulic press, carefully annealed, and finished according to standard practice at the Bethlehem Works, and they naturally feel that they have just cause for pride in the performances of both ships.

Train Nearly a Mile Long.

Some idea of the great length of freight trains now being hauled on some of the roads with the monster modern locomotives nowadays was well illustrated by one of the traveling engineers in the Cleveland convention, who said that on his road, which is quite level, they one day had a train of 118 cars and received orders to fill out at A——, where the train stopped, and took on ten more cars.

Ice a Good Insulator for Electricity.

On Mont Blanc, Switzerland, dry, frosty ice has proven a good insulator of the electric current. Successful experiments were recently made by laying a double line of ordinary galvanized iron wire on the ground between the top and base of the mountain. Each line was 5,500 feet long, and messages were sent without trouble. The loss of electricity, as measured by the instruments, was shown to be very slight.

Senseless Stricture in Suction Hose.

In the discussion on injectors at the Traveling Engineers' last convention, Mr. S. S. Smith cited an instance which had come under his observation, of a high-speed engine requiring rapid evaporation, which had but a 1¾-inch goose neck in the tank hose. He showed how unreasonable this was when he referred to the fact that years ago a small 16-inch engine used to have a 2¼-inch goose neck and 2½-inch hose.

The pamphlet of the Railway Department of the International Correspondence Schools gives a good idea of the extent of their business and their methods. Interiors and exteriors of the cars are shown, as well as a specimen colored plate of the air pump and its passages. This is a fine piece of color work, and it seems hardly possible to improve on this as a means of making its operation clear to students. The synopses of subjects give a good idea of the thoroughness with which each subject is treated.

When railroad companies conclude to reduce operating expenses, the most common practice in the past has been to lay off workmen, trackmen and shopmen being the most ready victims. The Chicago, Milwaukee & St. Paul have departed from that time-dishonored custom. Chairman Roswell Miller is authority for the statement that the company will reduce operating expenses by dispensing with the services of two vice-presidents. The saving thereby will be about $40,000.

In the introductory pages of *Poor's Manual*, just issued, it is shown that there are 190,833 miles of complete railroads in this country. The net increase in mileage last year was 3,981 miles. The aggregate capital stock of these roads is $5,742,181,181, and the aggregate funded debt is $5,644,858,027. The number of railroad corporations in this country is about 1,735 (not including private railroads), and about 910 companies conduct the traffic operations of all the railroads.

The B. F. Sturtevant Company, Boston, Mass., have issued a second edition of their catalogue—No. 101—on Steel Plate Planing Mill Exhausters. As is customary with this concern, it is full of information for fan users, giving dimensions, etc., and also contains a number of valuable tables with full explanation of them. A copy will be sent on request, and is well worth sending for.

The New York Air-Brake Company have ordered twenty Tabor molding machines for immediate delivery. They had another make of molding machine in their foundry, but the management decided to throw them all out when they had experience with the working of a Tabor machine.

The Joseph Dixon Crucible Company have just published an illustrated folder giving some interesting particulars concerning their Silica-Graphite paint, which will be found valuable for people who have to prevent iron and steel structures from suffering from corrosion.

J. E. Rhoads & Sons, Philadelphia, Pa., have issued one of the neatest belting and rubber goods catalogues we have seen. It is well illustrated all through, and contains much information. They make about everything in the way of belts, hose, gaskets, packing etc,

Deer Herds Block Railroad Trains.

Great droves of deer are reported crossing the railroad tracks between Grand Junction and Glenwood Springs, Colo. The animals number thousands, and at times interfere with passing trains. During the summer the deer are scattered over the mesas and tablelands of the northern part of the State, and in the autumn they start for the southern winter pastures and salt licks, several hundred miles south, rushing irresistibly over everything in their path.

"In spite of the disturbing influence due to election tin es," says the Buffalo Forge Company, " the books of this company evidence an increasing activity along its various lines. Owing to the press of work in our engine department, for instance, we have been compelled to run night and day on that branch of our work to keep up with orders."

In Memory of an Early Railroad Man.

MR. ALEXANDER SINCLAIR.

If there is one commandment which appeals to a Scotchman more than the rest, it is "Honor thy father and thy mother." A striking example of this occurred in Laurencekirk, Scotland, on September 8th, when a clock and chimes were given by the Sinclair brothers, as a memorial to their father. He died thirteen years ago, and was one of the early construction men of the Arbroath & Forfar Railway, now a part of the Caledonian Railway of Scotland, having begun work on the road in 1839.

The clock was formally started by the venerable mother, while Mr. Angus Sinclair presided at a children's festival and dinner which followed; the latter being attended by several members of Parliament and other notables.

In replying to the toast, "Our Latest Benefactors," Mr. Sinclair expressed his pleasure at being able to carry out the plan, which was his brother's, Professor Sinclair, of the Victoria University. His father being a staunch Free Churchman, they had placed the clock and chimes in the tower of the church he had worked for, and he trusted his memory would be revered by the present attendants.

The population of Laurencekirk turned out in full force to view the ceremony, and seemed to thoroughly appreciate the gift, which adds much to the convenience of the town.

The Pittsburgh Locomotive Works are said to be building an engine which will be composed exclusively of Pittsburgh products, excepting the driving-wheel tires and the headlight. The manufacturers of Pittsburgh seem to have great pride in using exclusively material made in their city. The Pressed Steel Car Company are said to be building cars in which Pittsburgh-made material is exclusively used.

The circulars sent out by the advertising department of the New York Central give a striking picture of the convenience of travel nowadays compared with what it was at a time still within the memory of men living. One circular says, "Distance is a thing of the past, when stage coaches lumbered through woody roads, the Far West stopped at the Niagara River and all beyond was as dark as the middle of Africa. Nowadays a man desires to go suddenly to Japan. He buys a ticket, a simple, gray slip of yellow-backed paper, and in a month he is there, sprightly, well cared for and safe. Modern travel is an exact science."

The highest honor of the Paris Exposition was "Hors Concours," meaning "outranking all competition," and being above the grand prize. The Standard Tool Company, of Cleveland, naturally feel quite elated over receiving this award.

The Traveling Engineers paid quite a compliment to the Crosby Steam Gage & Valve Company in their reports of committees. They copied, evidently by photography, twenty-eight pages of the Crosby catalogue dealing with the Crosby indicator and the directions for using it, as well as attachments and the Amsler planimeter. Full credit was given, and it speaks well of both the information in the catalogue and of the wisdom of the committee in using available material known to be reliable.

There has been for the last few weeks a great deal of speculating in the neighborhood of New York about the future of the Rogers Locomotive Works. Various interests and syndicates are reported to have bought the property. Being the seventh son of a seventh daughter, we feel like donning the garb of a prophet and saying we see before our eyes a combination of Charles Flint & Co. and Drexel & Morgan taking the Rogers Works unto their bosom.

CONTENTS.

(Continued on page 1.)

Locomotive Engineering

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A Practical Journal of Railway Motive Power and Rolling Stock

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The First Locomotive in the Holy Land.

BY WM. CRAWFORD, JR.

It was the third day of October, 1890. The tropical sun blazed high above in a cloudless sky, arraying the Oriental landscape in a sheen of dazzling brightness. The deep-blue waters of the Mediterranean rolled in foam-crested billows upon the glistening sands.

Close down by the seaside, partially surrounded by fast-decaying, moss-covered walls, nestled the little town of Joppa, just as it had for centuries and centuries. There were the orange orchards with their irrigating plants, grouped together at short distances from the town, and still farther away the partially cultivated tracts that dot for miles the plains lying between the sea coast and the mountains of Judea. But what a strange spectacle met the eye of a beholder. Thousands of many-colored flags and banners, gently wafted by the breezes from the sea, were displayed at every available point within the walls; the house-tops were completely covered by hundreds and hundreds of people, constituting nearly the entire population who had gathered together there to gain a better view of some great scene about to be enacted; while outside the walls a veritable army was encamped covering the beach and every neighboring point of vantage with its gaily attired thousands.

These people had been gathering there for several days past, and even then a caravan, dusty and tired from a many days' journey, could be seen slowly wending its way along a narrow path in the direction of the great concourse.

Many had come from far-distant places, bringing their families, and all were moved by an impulse of unbounded curiosity.

From the midst of this vast multitude assembled on the beach a small pier extended out into the sea for about 75 yards.

Quietly standing there on the farther extremity, amidst a confused mass of boxes, rope and the like, and partially surrounded by a busy little group of men, was an object quite unfamiliar to all—a very ordinary appearing American locomotive. Strange as it may seem, this was the center of attraction, and was the cause of bringing together the largest multitude that ever gathered before those ancient walls for purposes other than war!

Every cloud of smoke arising from that harmless engine was watched with intense interest by thousands of curious eyes, while the movements of the engineers on the pier called forth many grave doubts and superstitious fears, as to what the outcome would be, or as to what was to be done with that "big, black devil," that "mighty thing from the West," as they called it. These mysterious foreigners had created the monster there where it stood, and now what great feat of magic were they about to perform with it?

Its fame had spread to all parts of the country, and every inhabitant, if it was within his power had thus made the pilgrimage to Joppa to see this great wonder of wonders.

JOPPA—SEA TERMINUS OF RAILWAY TO JERUSALEM.

The track came from a point behind the town and ran along an embankment on the beach, finally reaching the pier and coming to an abrupt end at the farther extremity. It was out on the end of this pier that the engine had to be constructed, because there were no facilities to do the work elsewhere. About ten days were so consumed, and at last the memorable day arrived when the first wheel was to turn.

During the afternoon, a long, loud blast from the whistle struck terror to the stoutest hearts among the natives and caused all with one accord to join in a general stampede. Up and down the beach in either direction they fled leaving everything behind in the wild endeavor to escape from some terrible evil, as they imagined it.

It was long after the last faint echoes died away that the multitude had reassurance enough to return.

Hardly had the confusion and stampede caused by this first great surprise subsided, when the little engine, seeming to realize the honor and distinction bestowed upon it, proudly made its way along the glistening rails. Right through a now frantic crowd of these half-civilized Turks and Bedouins and on to the end of the line, bedecked with flags and bunting!

It was indeed a most surprising scene, and one never to be forgotten by those who were present, to see a race of people presented with an institution in one single day that it took years and years of mechanical invention and scientific research for us to attain.

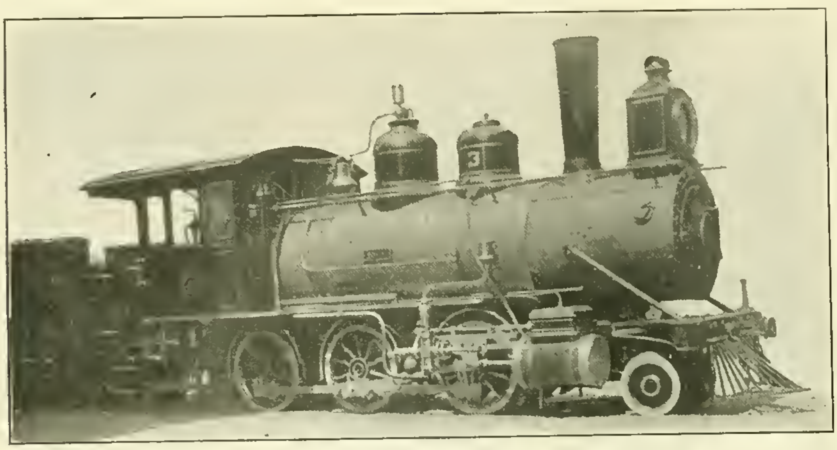
Palestine under the Turkish control was several hundred years behind the rest of creation, and previous attempts to reconstruct and elevate the sacred land by the introduction of a railroad had proved dismal failures.

The difficulties attending such a project can be readily understood when it is known that every bit of material used, even down to the coal necessary to operate the road after completion, had to be imported from either Europe or America. The coal, for instance, was such a rare article that the piles of it, brought from abroad and stored away for future use, had to be guarded night and day by soldiers, to prevent its being carried away. Even this did not suffice, for the guardians themselves managed to sneak it off in small quantities, making it necessary to white-wash the piles, so that when any was removed it could be instantly detected by the black patch left.

The glass in the car windows was a new thing also, and in order to prevent the unsuspecting passengers from sticking their heads through the panes, it was found necessary to paste small circles of paper in the middle of each. These served as a reminder of the presence of glass, and had to be used until all had become accustomed to raise the window before looking out.

Ten years of experience have now done away with all the little difficulties, and the railroad has grown to be a practical paying institution.

Nevertheless, it seems strange when we stop and think that nowadays it is a common occurrence to have a Mohammedan priest interrupted in his call to prayers by the whistle of the morning train coming into Jerusalem station, or we can picture to ourselves a shepherd and his flock away out on the plains of Judea, or a group of Bedouin horsemen patiently waiting at a crossing while the west-bound express rattles past on its way to Joppa.



FIRST LOCOMOTIVE FOR JOPPA & JERUSALEM RAILWAY.

Reducing Unnecessary Stops.

There is nothing so annoying to the locomotive engineer as the presence of a red light at some insignificant branch road crossing on a main line, at a point where all the conditions except the miserable signal indications are favorable to unlimited speed. The great Pennsylvania lines system has suffered greatly from such detrimental crossings, but owing to freight and passenger business originating from the intersecting lines, have not been in a position to make any determined kick; but recently the aggressiveness of the Vanderbilt lines has compelled the Pennsylvania lines to make some move to get rid of the unnecessary stops. They had to make this move or reduce the number of cars on fast passenger trains, and viewing their action from the point of public safety, they ought to be given credit for urging upon the State government of Ohio the necessity for compelling the short lines to cooperate with the trunk lines for interlocking safety switches and towers at all the grade crossings.

The Panhandle is particularly unfortunate in the matter of grade crossings, and the fact that they have managed to arrange for interlocking plants at Covington and other points will be pleasing information to the engineers and conductors.

The engineer on the locomotive of a fast express train grows old before he reaches the two-score limit, simply because he has so many worries. He tries to make the fast schedule time, and when he strikes a favorable stretch of track on an easy grade he cuts loose and gains a momentum equivalent to 70 miles an hour, but just at the place where this terrific rate of speed could be utilized to counteract the effect of an ascending grade and save coal, and at the same time give the poor fireman a chance to get his breath, the red light at the grade crossing commands a halt, and there is another weary climb up the hill with a wonderful waste of coal.—*Pittsburgh Post.*

Locomotive Design.

Mr. Waldo H. Marshall, superintendent of motive power and machinery of the Lake Shore & Michigan Southern Railway, gave the second in the series of lectures in the railway course at Purdue University on Thursday, November 1st. His subject was "Locomotive Design." Mr. Marshall discussed first the conditions which control the selection of a type of locomotive which is to render a given service. He urged the importance of making the machinery light, so that all available weight may be put into the boiler. The possibility of improving present designs by the adoption of steel for wrought and cast iron was carefully reviewed, and examples were given of recent achievements in this direction. In a similar manner, other problems of design which are general in their application, but which readily resolve themselves into matters of detail, were forcefully discussed.

In conclusion, the conditions to be met in working up a design were defined as (1) safety, (2) efficiency and reliability in service, (3) economy, and (4) beauty of the whole design. Upon the last point he said: "The modern locomotive, with its mammoth proportions and simple outlines, its great boiler indicative of power, and its well-proportioned machinery, is altogether too magnificent and majestic a piece of work to leave the hands of the designer in a crude and unfinished state. A handsome locomotive hauling at high speed, and apparently with so much ease, a long passenger train, or dragging with slower motions many hundreds of tons of freight, is a sight which pays the designer for all of his labor, and if we reflect upon the great work which the locomotive is doing, and will yet do, for mankind in the development of the resources of nations and the extension of the bounds of civilization, we find inspiration for careful, conscientious work, in the assurance that whatever can be contributed to the perfection of the locomotive is worth the best efforts of the mechanical engineer."

Earnings of Railway Employes.

State Labor Commissioner Rixey of Missouri has made an investigation of the average daily wages and yearly earnings of employés of steam railroads in that State. He finds that 22,672 persons are employed by the fifteen principal railroads operated in Missouri. There are 99 general officers whose average daily pay is $8.28 and whose average yearly earnings are $2,964; 1,050 locomotive engineers earn an average of $3.58 per day and $1,199 per year; 776 conductors earn an average of $3.20 per day and $1,104 per year; 1,079 firemen average $2.14 daily and $710 yearly; 674 station agents average $1.67 daily and $578 yearly; 59 master mechanics and roadmasters get an average of $3.99 daily and $1,420 yearly, and 5,171 trackmen average $1.18 daily and $388 yearly.

Preparing to Pass Examinations.

BY C. B. CONGER.

So you are to be called on for the mechanical and air-brake examination before long, and you want to know what are the best books to study in order to be prepared to pass in good shape, do you? That inquiry uncovers the fact that you are afraid you will not pass and that you have not tried very hard to learn all that is necessary.

Well, it is a poor plan to wait till the last possible minute to learn about matters connected with the operation of the engine equipment that you should have learned years ago; but that sort of advice doesn't help you out any, and LOCOMOTIVE ENGINEERING wants to help you out whenever you ask for it.

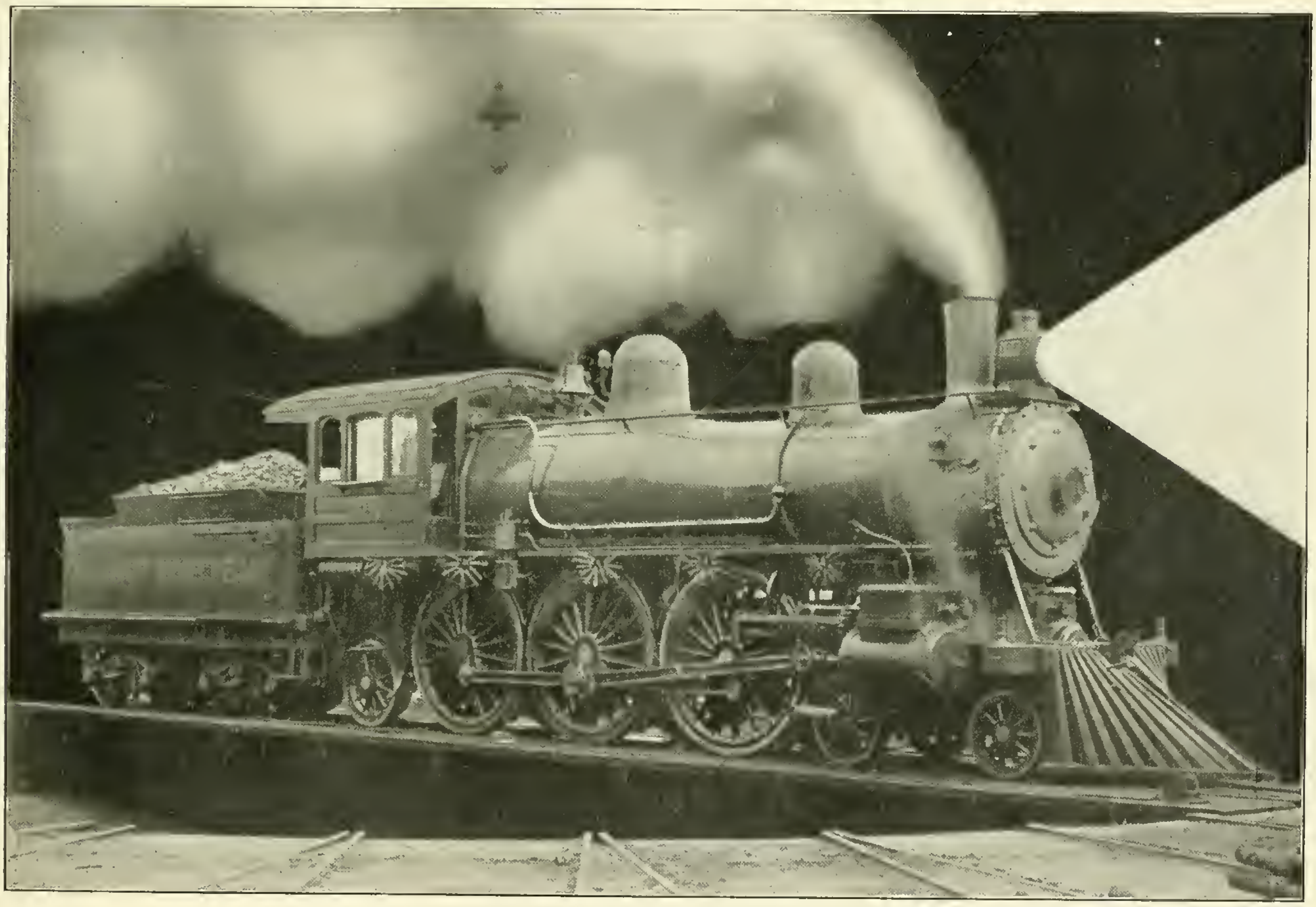
What you want to know now is, What shall we study in order to get the most information in the shortest time? A railroad man cannot study very much between trips, and it costs money to lay off.

There are a great many books now published which tell you about the operation of a locomotive with its various attachments, of which the air brake, the link motion, the injector and the lubricator are the best explained on the printed page. Some of these books are only copied from the others. It pays to get the ideas from the original source when you can.

One of the very best books that you can study is the engine that you are working with. What it says to you is not as easily read as the same information on a printed page, but if you go at it right, the study of the construction and operation of the locomotive will give you more live and interesting facts than half of the books that you can get hold of. Of course there is one bad feature connected with using the engine itself for a text book—you cannot have it at home for a reference in the hours you may have to devote to study; you have got to go where it is, and read from it in the shop or on the road. The printed book can be your companion to consult on any matter of information shown on its pages; the engine must be taken to pieces to study it.

If you use the engine itself as a text book, study it thoroughly if you wish to understand its various parts and their relation one to another. Knowledge is only gained by some exertion of mind. Do not figure that knowledge will come to you like driftwood down a river. Go out after it, and go after it hard.

Take the boiler for the first chapter, note where the steam and water are confined, where the feed water enters the boiler and where the steam goes out. There is a good reason why the water enters among the flues as far as possible from the hot firebox sheets, and why the steam is taken from the highest point in-



ELECTRICALLY LIGHTED LOCOMOTIVE, BELONGING TO PLANT SYSTEM.

side the steam dome. Why is it, you say? So that the water will come in at the coolest part of the boiler and work towards the hottest part. This saves the boiler and aids the natural circulation of the water. Steam has less water in the shape of spray up in the top of the dome than at the surface of the boiling water. Dry steam is what we want.

The next point after learning about the construction and operation of any part of the locomotive is to learn what is most likely to be disabled and what to do in case of a break-down. If you are going to depend on someone else to tell you what to do in case of break-down, you must either trust to your memory for what he told you, or have your informant with you when you use his method.

But if you understand the construction and operation of the engine, it is easy to figure out, when any part becomes disabled, whether you can put things back in their original condition and go ahead, or whether part of the machine must be disconnected and put out of service. This information can be read from the engine as a text book; but, like a good many sure methods, it is a little slow.

The next chapter in the regular course is, how the boiler with its draft appliances in the front end and steam pipes to the steam chests is connected to the engines. The frame is really a part of the engine, but the weight of the boiler is carried by the engine frame and distributed to the various bearings by the equalizers and springs. If you find out how the weight is distributed—first to the frame from the boiler, cylinders and deck plate, and next from the frame to the equalizers and springs, then to the boxes and journals, when all are in good order—it is not much of a job to figure out where the blocks should be put in after a break-down, in order to carry the engine in to her destination without unnecessary delay.

Then, after the proper distribution of the weight is thoroughly fixed in your mind, take up the question of break-downs in the motion work, rods and parts that are of use in the steam distribution and the parts that carry the power of the steam back to the wheels and from thence to the drawbar.

In this last chapter the printed book will help you out most, as these matters need so much explanation that the engine will not give; it cannot talk to you as the printed page does.

Now as to the proper book; be sure and read one that is up to date. An old instruction book or manual that talks of the engine in use fifteen or twenty years ago is of little use to-day. If it tells about small eight-wheel engines and small moguls, while you are working with ten-wheelers or consolidations that weigh 60 to 80 tons for the engine alone, you will find that the methods for handling small engines when disabled will not do for the big fellows.

For instance, the old books tell about jacking up an engine in case of a broken spring hanger or equalizer; but do you think that you could jack up one of the big fellows with the little screw jacks you find on the engines to-day? You will have to learn how to run an engine up on blocks or wedges; raise up one wheel at a time and block up the broken parts so the good ones are level in their proper places. Then with the big engines it is quite the thing to come in without taking down the main rods in case the eccentrics or valve motion is disabled on one side. Don't see how they do it, you say. Well, if live steam goes into the steam chest, block your valve so the back steam port is open just a trifle, so as to lubricate the piston and walls of the cylinder; the lubricator will do this, as well as to move her off the center when the good side gets on the center. Leave both cylinder cocks open on the side that is blocked and you can run right in. When she sticks on the center, shut the back cylinder cock, and the steam leaking in the cylinder will soon move her. One of the best books to read is an up-to-date mechanical journal like LOCOMOTIVE ENGINEERING, which is in the business of stating facts for those who are learning, so they can learn them easily. Lots of people know about what you are trying to learn, but unless they tell it in plain, practical language, it does not help out the men who are in need of immediate information. While reading a monthly publication may not give you all the information that you wish you had, in one month, yet if you study it over, it will give your reasoning powers a training that will enable you to figure out some difficult combinations.

Do not think that glancing over it in the reading room will give you this information; take a copy home with you and read it over till you have the facts securely located in your mind. Then it will do you some good.

Another Oldest Engineer.

Gideon Hawley, who runs an accommodation train on the Lake Shore Railroad from Conneaut, Ohio, to Cleveland, says an exchange, is the oldest engineer in active service in the United States. Mr. Hawley, who is seventy-three years old, has been fifty-two years at the throttle. He began railroad work as a fireman in 1846, when one of his duties was to stand at the front of the cabless locomotive to sprinkle sand on the tracks from a wooden pail provided for the purpose. The wooden pail was filled from some bank here and there along the route, as time was not a matter of importance. In the forties 20 miles an hour was considered good speed for a passenger train, while the freights made only 7 miles.

The first place obtained by Mr. Hawley was on the Michigan Central. The wheels of the tender were then set by brakes, the only ones, by the way, on the old-time trains, and it was the duty of the fireman to operate these brakes. He found that his labors were varied and exacting, but after four years of service he became an engineer, entering the service of the Lake Shore road in 1852.

The engineer then had many responsibilities that are not now put upon men who operate the great locomotives. Headlights were not used, and it was risky work to run an engine in the darkness, especially when the single tracks were in use and the railway companies did not maintain their own telegraph lines. The cowcatcher, however, was one of the first appliances, although the primitive invention was of very different pattern from those in use to-day. Trains made their way from one station to another depending on flagmen who were employed in great numbers. These flagmen managed to obviate the need of dispatches, except in cases of emergency, when messages were sent at regular rates. There were regular sidings, at which the trains pulled out to allow those coming in an opposite direction to pass. Mr. Hawley remembers that he spent many anxious hours when he was compelled to run his engine on in the hope that he would make the next station before a delayed train left it.

While employed on the Michigan Central Railroad, Mr. Hawley visited Chicago, which was a flourishing country town. After leaving the Michigan Central, he obtained a position on the Mad River & Lake Erie Railroad for a short time, and he ran his train through a wilderness that was sparsely settled.

The Lake Shore Railroad, in addition to employing the oldest engineer now actively engaged, has the distinction of having the oldest conductor on its payrolls. He is Edward Page, of Cleveland, and he has charge of the fast mail trains. He was conductor of the train that carried President Lincoln to his inauguration and also of the train that carried the President's body home from Washington. George Martin, who died recently in Cleveland, was the engineer on both these memorable occasions.

The tram-cars in Belfast have emphatic directions as to politeness. At each end of the cars, in large letters, is displayed, "The lifeboat rule is women and children first," while in the interior of the cars a prominent notice reads, "Spitting in tram-cars is a filthy habit. Persons committing this offense will render themselves liable to the disgust and loathing of their fellow-passengers."

In making a deep cutting for a railroad extension near Pittsburgh, Pa., the Pennsylvania Railroad people went through a seam of coal 11 feet thick.

Rogers' Ten-Wheeler.

The ten-wheel locomotive here shown is one of the latest engines built by the Rogers Locomotive Works and was for the Calvert, Waco & Brazos Valley Railroad. The engine is very powerful, is intended for freight service and has cylinders 20 x 28 inches and driving wheels 62 inches diameter. A few of the leading particulars of the engine are:

Drivers—Number, 6; diameter, 62 inches.

Driving-wheel material—Cast steel.

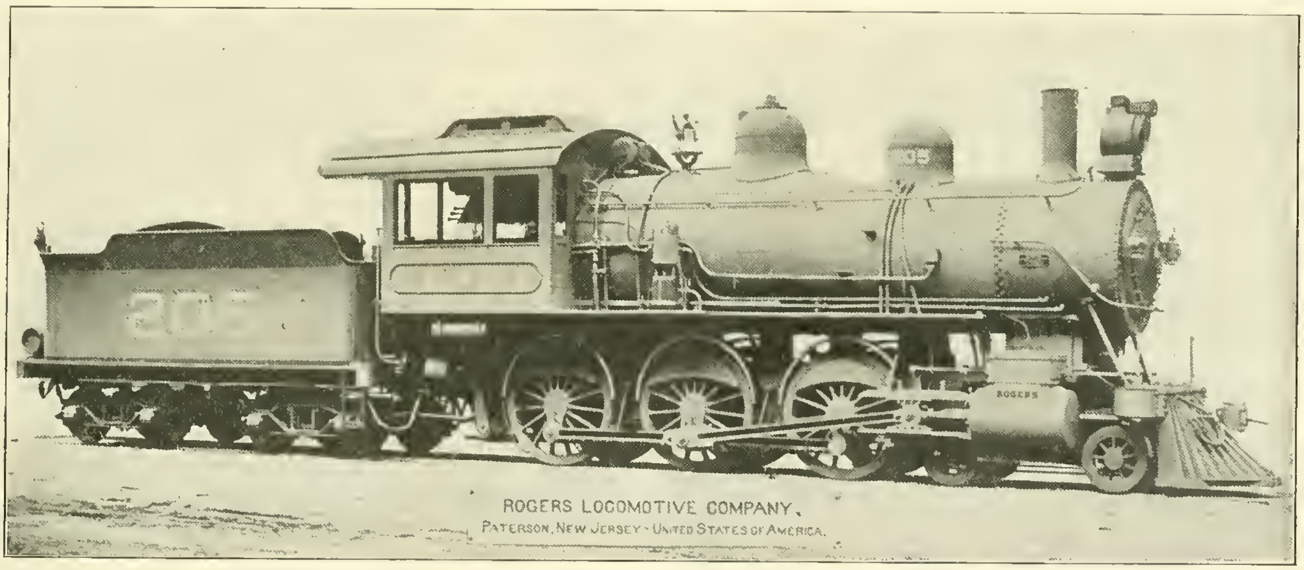
Driving-axle material—Steel; journals, 9 x 12 inches.

Driving wheel-base—13 feet.

Total wheel-base of engine—23 feet 10 inches.

Weight on drivers—130,000 pounds; on truck, 32,000 pounds; total, 162,000 pounds.

Heating surface—Tubes, 2,226.7 square feet; firebox, 190 square feet; total, 2,416.7 square feet.



ROGERS TEN-WHEELER FOR CALVERT, WACO & BRAZOS VALLEY RAILROAD.

Grate area—35 square feet.

Tubes—Diameter, 2 inches; length, 13 feet 6 inches; thickness, No. 11 B. W. G.; number, 315; material, National Tube Works iron.

Grate—Length, 120 inches; width, 42 inches.

Boiler—Type, extended wagon top; diameter, inside front, 66 inches; working pressure, 200 pounds; thickness of barrel, 11-16 inch; dome course, ¾ inch; crown, ⅜ inch; tube, ½ inch; side, ⅜ inch.

Wheels—Engine truck, diameter, 30 inches; kind, steel tired.

What is Steel?

In a lecture delivered at Glasgow, Scotland, by Mr. James Riley, of the Steel Company of Scotland, he remarked: "I doubt not that many of the outside public have been surprised and perplexed at the idea of steel being used in the construction of ships and boilers, the name 'steel' being associated in their minds with sharp cutting instruments of hard and possibly brittle character. In the same way, but of course, not to the same extent, many who have been engaged in the use of iron for a long period, and thoroughly understand its characteristics, but who have had no practical acquaintance with the newer classes of 'steel,' have no doubt had many misgivings as to the propriety of its use in these directions, and also of their own ability to deal successfully with it should they be required to use it in their ordinary occupations. These ideas have contributed largely to that disinclination to adopt the 'new material' with which steelmakers have been so long and so successfully contending. The application of the term 'steel' to the newer classes of this metal was indeed unfortunate, so far as the makers were concerned, and has contributed not a little to the many difficulties they have experienced in the conduct of their business. Even in the minds of experts there has been something approaching to a confusion of ideas regarding these metals through the use of the term 'steel,' and some efforts have been made to get over the difficulty by a division into classes, whereby the milder or softer should be called 'ingot iron,' or homogeneous metal, while the harder retained the older designation of steel; but difficulties which I need not here enumerate have prevented the general adoption of this proposal. Now the definition is pretty generally accepted, that steel is an alloy of iron which is cast while in a fluid state into a malleable ingot. Yet this does not cover some of the steels manufactured. Speaking generally, steel is an alloy of iron, and this principally with carbon, and the aim of the manufacturer is to obtain the alloy with such proportions of each as shall best fit it for the purpose for which it is intended.

The Wheel.

Very few of the millions of human beings who patronize the steam railroads of this country realize the vast amount of work which the railroad corporations have done in the effort to perfect the modern car wheel. No matter how palatial the interior of the coach or the sleeper may appear, and no matter how solid and substantial the framework may be, all depends upon the wheel.

It must be remembered that no historical sketch tells us the name and nationality of the inventor of the wheel, and yet away back in the dim mists of antiquity some human genius perceived the vast benefits that might be derived from taking advantage of a solid body in the form of a perfect circle, which, with slight resistance, might be moved along with a heavy load resting upon it.

The common cart, the farm wagon, the carriage, the street car, the bicycle and the locomotive, all work upon this principle. It was one of the most wonderful of primitive inventions and has created one of the most amazing revolutions in travel over the surface of the land. It has also been the means of providing power in manufacturing establishments, and to-day it is impossible to find a single industry where machinery can be employed without the use of the wheel.

In the future the genius who discovers perpetual motion will be the inventor of a mechanical principle greater than the achievement of the prehistoric individual of the genus *homo* who designed the first wheel, but it will take ages of slow intellectual development to discover the great powers now hidden in the mists which no human eye can penetrate.

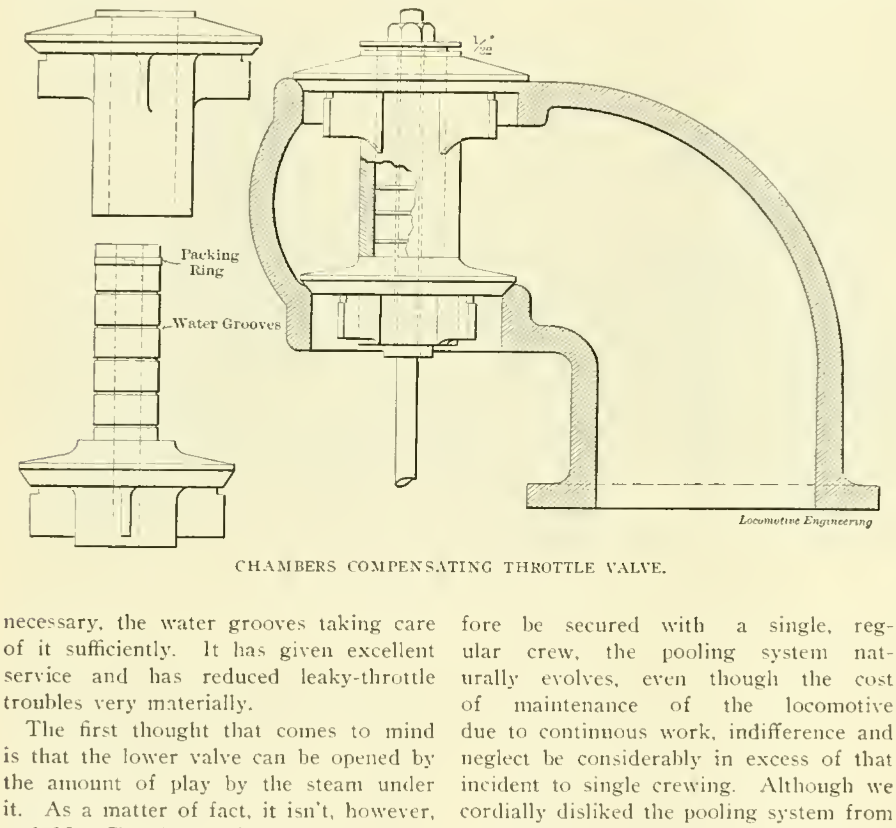
To-day the common wheel—nothing less than a complete circle—is the base and foundation of all our advancement. The different railroad mechanics are endeavoring to make it still more reliable and perfect, and the problems of centrifugal and centripetal forces and also the effects of thermal heat have been carefully investigated.

A New Throttle.

A new idea for a throttle valve has been worked out by Division Master Mechanic Chambers, of the Central Railroad of New Jersey, and a patent has just been allowed on it.

The construction is shown quite plainly by the accompanying cut, from which it will be seen that the two seats are separate, fitting together as shown and acting as a solid valve, while allowing for expansion and adjustment. The projection on lower seat extends 1-32 inch through the upper seat, and the movement is limited to this amount by a washer on the stem, as shown.

In the drawing a packing ring is shown at the top, although it has not been found necessary, the water grooves taking care of it sufficiently. It has given excellent service and has reduced leaky-throttle troubles very materially.



CHAMBERS COMPENSATING THROTTLE VALVE.

The first thought that comes to mind is that the lower valve can be opened by the amount of play by the steam under it. As a matter of fact, it isn't, however, and Mr. Chambers informs us that they give no trouble from this source.

The Pooling System.

The following is brief, pointed and interesting:

Editor:

Will the pooling or chain-gang system of dispatching engines ever be done away with, and are the men and engines as well off as when each crew had its own engine?

ENGINEER.

When experience has proved the system less remunerative and more expensive to maintain as a whole than that where each crew has and keeps its own individual engine, then will pooling be abolished, and not before.

No exceptionally keen penetrative powers are necessary to see that the more continuously the wheels of a locomotive can be kept revolving in hauling trains over the road, and the more it can be kept out of the roundhouse stall, the more money it will make for the railroad. In turning the engine around and sending her out again immediately upon each arrival at the terminals, the highest maximum work possible is obtained. It is this maximum that the system of pooling seeks and closely approaches.

An engine's place is out on the road at the head of a moving train, with no idle intervals except for coaling, watering and running repairs. Man, however, is, to a limited degree only, a machine, and must have periods of rest and recuperation; and, as the brain and muscle machine cannot keep pace with the iron machine, and the maximum output of the engine cannot therefore be secured with a single, regular crew, the pooling system naturally evolves, even though the cost of maintenance of the locomotive due to continuous work, indifference and neglect be considerably in excess of that incident to single crewing. Although we cordially disliked the pooling system from an engineer's point of view, and freely confess that its adoption by the road on which we were at the time employed was so distasteful as to force our resignation from the footboard and to send us hither to seek pastures new, we are forced to admit, nevertheless, that the pooling system, from the railroad's point of view, and that is the one that counts and really determines, is generally successful.

After a season's trial some certain roads have abandoned the pooling system, others retain and speak of it highly, and others still are satisfied with the old system and don't care to change.

The increased earning capacity of the locomotive, however, had by keeping it out on the road hauling revenue-bringing trains continuously, so far outcontroverts all contrary arguments as to destroy any reasonable hope of a general return to the old single-crew system.

But are the engines any better off?

Surely not! With the introduction of the pooling system the ownership of the engines passed from the crew to the railroad company and the well-groomed, well-kept iron horse was gradually but surely transformed into an untidy, loose-jointed beast of burden. Anybody's engine is nobody's engine! We hear no more the ancient familiar story of the old-time master mechanic searching in vain with his spotless white cambric handkerchief for a speck of dirt on the inner hubs of the driving wheels and eccentrics. This gentleman's thoughts are least with clinging clots of grease and blotches of grime, and are on other things. He is being prodded by his superiors to get the engine out of the roundhouse stall, to keep her out and make her drag an additional ton of freight, if possible. These officials and stockholders are cold-blooded, unsympathetic persons entirely devoid of railroad tradition and locomotive romance, and love the engine only in exact proportion to the dollars she can earn. No! The engine is worse off, but she makes more money for the railroad company.

But how about the men?

They are really better off! And especially if the fireman is relieved from cleaning. Then there is an end to sweating and rubbing over a hot jacket and a hotter boiler head. The day's work begins with the trip and ends with it. There is an end to the everlasting tinkering and "puttering around" on the engine in the roundhouse stall, and the crew's time is better spent at home or elsewhere outside of the roundhouse. While it seemed a great sacrifice to have to give up the clean, solid engine for one not so tidy and good, the increased freedom from responsibility and the greater number of leisure hours thereby obtained would seem to argue strongly in favor of the men in the pooling system. Therefore, the statement that the pooling system has come to stay, that the locomotive is not in as prime condition as formerly, but makes more money for the railroad company, and that the men are gainers instead of losers can generally be considered true and accurate.

Spain may be behindhand in many ways, but she has made a step forward recently. The Queen Regent has decreed that on and after January 1, 1901, the continuous or 24-hour system of time shall be used in all railway, mail, telegraph, telephone and steamship lines and all ministerial offices, courts and public works. Midnight is to be 24 o'clock, while 12 o'clock is noon, as at present. The time between 24 and 1 o'clock will be designated as 0.05, 0.10, 0.59, etc.

General Correspondence.

All letters in this department must have name of author attached.

What is Unskilled Labor?

The line between skilled and unskilled labor is not always easily drawn, and the question of proper remuneration is equally difficult. The "drill-press machinist" is looked down on by an all-round mechanic as only a step above a laborer, and his pay is usually on a par with this view of his ability. Yet in the case of engine work, or anything where the castings are used, the opportunity for doing damage is almost unlimited.

A cylinder may weigh several thousand pounds, may be bored and faced, valve seats finished, and have several days' work on it before being drilled for studs and bolts. A blunder on the part of the drill-press man may make it worthless. The man loses his job, the employer his money, and the customer his temper at the delay. By the use of jigs and templets the chances of this are reduced very materially. They are also reduced by having the work done by more experienced and better-paid mechanics.

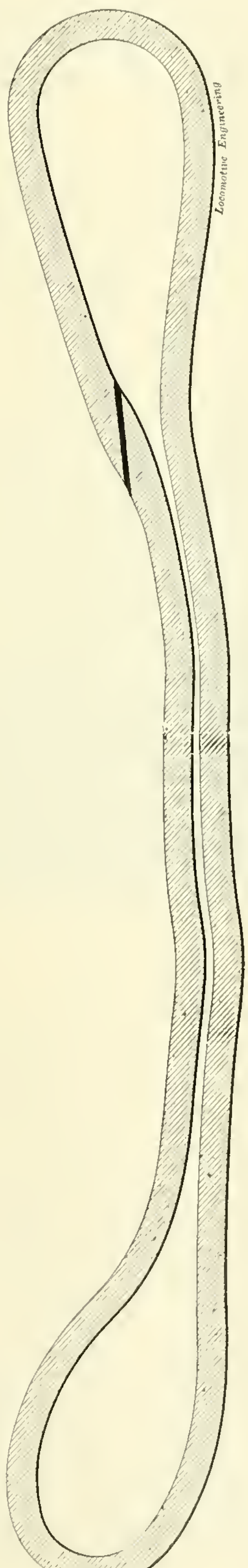
As the employer must stand the loss in any case, it becomes a question as to how much the payment of higher wages insures him against loss, just as it is a question how much money he can afford to put into jigs and fixtures.

Another and even more striking phase of this problem is the case of traveling-crane operators. This is a position which demands instant compliance with orders, either by sound or sign. It requires a steady hand, an unshaken nerve and a freedom from getting rattled, no matter what happens. A recent instance of this was in a foundry where a huge ladle of steel was being carried to the molds. The bottom of the ladle caught on a projecting bar and was in imminent danger of being spilled on some nearby workman. Quick as could be, the crane man stopped the forward movement and began to hoist, preventing several thousand pounds of molten steel being spilled over the workman.

Similar cases frequently occur in machine shops, where a false move would smash valuable machinery and perhaps kill a dozen men. Yet few accidents happen, which shows that even the rather poorly paid labor (when the conditions are considered) gives excellent results.

The possibilities for doing damage by anything but the most delicate handling are shown in assembling large pieces of machinery by the crane. I recently saw a large machine in which the interior piece weighed several tons, and which had to be lowered into place in exactly the right position. Certain parts fitted together within three one-thousandths of an inch, and these must be lowered into place without damaging either part. That this can be done shows excellent mechanism in the construction of crane and remarkable handling by the operator. The question is, What is it worth to have a crane handled like this? I. B. Rich.

Honeybrook, Pa.



A COLLAPSED DRY PIPE.

A Collapsed Dry Pipe.

Enclosed please find a section of a copper dry pipe just removed from an eight-wheel 18 x 24 passenger engine. (An exact diagram of the pipe is here reproduced). This pipe was flattened about 6 feet in length, and presents some points for reflection. The engine has been running for the past week in this condition, because it was impossible to take her out of service on account of shortness of power. During the week or more that the engine was in service, she had been hauling from eight to twelve cars on nearly a level road; and while there were several complaints made and the cause presupposed by some to be lack of lead, the engine has never lost but a few minutes on running time, and upon two occasions has made up time.

Upon one occasion she pulled a train of ten cars, consisting of baggage, express, smoker, day coach, Pullman, tourist and four standard Pullman sleepers, a distance of 89 miles, making nine stops, in 3 hours and 6 minutes; 30 minutes of this time were consumed in making 1½ miles *via* ferryboat, which would leave 87½ miles made in 2 hours and 36 minutes, or, in round numbers, 33 miles per hour, with nine stops included.

This might lead to the conclusion that the advocates of short ports have some ground on which to base an argument, also that the large amount of lead opening advocated by some is not essential.

It is probably useless to add that the engine did not burn anywhere near the usual amount of coal, and was a fine steamer, according to the fireman.

No fault was found in starting the train, the only difficulty being that the limit of speed was reached earlier than usual.

Oakland, Cal. D. P. Kellogg.

[We have measured the opening of this section of dry pipe and find it to be 2.5 inches. It is surprising that steam sufficient to do heavy work of train-hauling could pass through this restricted opening. —Ed.]

Abolishing the Pooling System.

After a trial of over two years, the Atchison, Topeka & Santa Fé Railway Company are abolishing the pooling system. This does not include the entire system, at present, but probably will in the near future. The divisions on which the system is being abolished are the mountain divisions, and the valley divisions where cattle shipping is the principal part of the business.

Although the system is unpopular with the men, it has some advantages. During heavy business an engine can come into the terminal, receive the work that is absolutely necessary and then be sent out again, not waiting for the crew to take their rest. As engines not requiring work are not held by the crew awaiting their turn, fewer engines can do the work, as the engine is kept on the road every minute it is not in for repair. The most available engine can always be sent out without being delayed by engines requiring more extensive repairs. The despatcher can select an engine of suitable size for the train. With the pool system an engine crew are not required to lose time when an engine breaks down. The company are doing all the cleaning, except the cab, so this is something that is considered by the firemen.

On the other hand, the pooling system has many disadvantages, some of the important ones being that the crews become indifferent and neglect to report repairs and fail to remedy small evils as they would if they had the engine regularly. Engines go over the road with the rods and driving boxes pounding, injectors that take part of a week to prime, injector throttles leaking, lubricators with glasses full of sediment and the joints leaking; handles broken off gage cocks and air pump throttle, an air pump that does more groaning than pumping, a fire door that won't stay open, a shaker-bar that slips off the post and permits the fireman to go back against the coal gate or else "take a run for the boiler head," and other defects too numerous to mention.

The wear of valve and running gear is great on account of some men being careless, and too close attention to oil records on the part of others. An engineer can make an oil record at some other's expense by using just enough to get over the road. The next man on the engine must make up for the deficiency or be troubled with squeaky valves, hot boxes and delay reports. The engine soon gets lame, and as she is in the pool it is not reported, as one man does not care to report more work than another, and the crew do not expect to get the engine again, so do not care.

The steaming qualities of engines are neglected. A fireman has a new engine to learn each trip. As a man must learn to fire an engine before he can be economical with fuel, there is a great waste of coal, as each trip is an experiment. One man succeeds with a poor engine and gets over the road; so as long as anybody can "keep her hot," there is no change made, as no two suggest the same remedy. As a man is probably only on an engine one trip he does not have time to locate the trouble, then somebody else tries it, and so the engine continues a poor steamer.

On a pool engine there are few conveniences. If anything is broken or lost, if not absolutely necessary, it is gone forever. Before the engines went into the pool, nearly all engines were equipped with a hose for wetting down coal, but they soon disappeared.

As the pool has passed, the little comforts are being replaced and the engine seems more home-like and work more pleasant. The lamp chimneys and glasses that used to look as if they had been prepared for viewing an eclipse of the sun, are cleaned once more, and the classification markers are brighter than a pool headlight. The fireman has the satisfaction of knowing that his lamps are filled when he is called to go out in the night. Steam and air gages and water glass can be seen as the lamps are adjusted to throw their light in the proper place. The headlight has been hunted up and can now be seen without the aid of a lantern. The tank is filled with coal instead of being one or two tons short, as it was in the pool. The engine crew can also tell whether it will be safe to try and make a meeting point on short time, as they know what the engine will do.

I hope this will be some comfort to the brothers who are still in the pool.

Andrew C. Adams.

Wellington, Kan.

Singular Hold-up in England.

The following method of collecting a debt is seldom resorted to by railroads in this country, and a brief description of a recent instance of it may therefore prove interesting to your readers.

The South Eastern & Chatham road, of England, was indebted to the Great Northern for a certain sum of money, and in the fullness of time the Great Northern requested liquidation of the debt. The South Eastern & Chatham promptly refused to liquidate—a refusal which their creditor described as "a gross breach of etiquette." The South Eastern & Chatham hereupon appear to have regarded the incident as closed; but this, as the sequel shows, was exactly where they were wrong. They had running powers over a certain portion of the Great Northern system, and one fine morning, while six of their trains were in the enemy's country, they were held up by the Great Northern, who had executed a masterly flanking movement to attain this end. Then the Great Northern disconnected the six South Eastern & Chatham engines and made them proceed under their own steam to a Great Northern roundhouse, where they were locked up, "pending a settlement." Naturally, the indignation of the South Eastern & Chatham was immense; but they were very short of rolling stock, and they paid up.

Hugh Sharp.

Abilene, Texas.

Holland Making Coffins.

The day after we had written our correspondent, Mr. W. D. Holland, asking if he was still in the land of the living, we received from Manzanillo, Mexico, the following letter:

"It has been quite a while since I wrote you, but have been busy here as master mechanic of the port works since June 1st. It is not a very healthy place, so my resignation is in. Our general manager here was short 100,000 feet of lumber. When he was asked for an accounting, he reported that I had used it up making coffins and head boards. As he said it was buried, it was no use in measuring for it.

"I had a funny experience the other night. At this port when a person dies of fever he must be buried at once. A Mrs. Perkins was awful sick, and the doctor told me to get a coffin made. He gave me the size, and said if she did not need it, it would do for someone else. As we were short of ice, he also told me that the only thing would cure her was ice; so I started at once the ice plant which I have here. It seemed funny—the carpenters were busy making a coffin in case she died, and the ice plant was running fast making ice in case she should live. Regret to say she died; so closed the ice plant down for the night.

W. D. Holland.

Crossheads Out of Line.

A careful inspection of twenty-odd cylinders of heavy locomotives which had been in use for some time disclosed the fact that only two pistons were traveling in alignment with the central longitudinal line of the cylinder's bore. This was evidently on account of the crossheads being too low, which defect can be attributed to the carelessness and unskilfulness of the mechanical department.

The engineer's part is to point out, on arrival at terminals, such existing imperfections as he observes, and leaves it to the discretion of the machinist as to the accuracy in the performance of the work. Yet, in nine cases out of ten the machinist who is assigned to execute the work will line the guides down, and of course the piston also goes down.

The chief object of the crosshead is not only to guide the transmission of power from the reciprocating motion to the rotary, but also to keep the piston traveling centrally through the cylinder. The weight on the guides of heavy consolidation engines will weigh a half a ton or more. While such engines are descending grades, this weight bears on the bottom guide-bar; hence the wear is more rapid than when the engine is forcing her way ahead. In this case the wear is principally on the top guide-rail. Those features should be carefully considered when the guides are lined.

A few of the most conspicuous indications of a low crosshead are here mentioned. This defect will cause steam to escape between the metallic packing and the top of the piston rod. The piston rod will ride on the bottom of the packing and will wear the metallic packing out rapidly. It will cause ominous noise in the cylinders when drifting into stations. The piston ring being loosely held against the top of the cylinder, causes this noise. It will wear the cylinder oval. These conditions partially convince the engineman that he is not supplying the cylinders with a sufficient quantity of cylinder oil and regulates his lubricator to feed more rapidly. This practice soon taxes the cylinder oil supply beyond its capacity. To replenish his lubricator an additional supply of oil must be had at all hazards, or his engine will presently be be ruined (?).

It is imperative that such an important factor in the efficiency of an engine as the crosshead should be accurately adjusted, so that the piston will travel in its proper position. JAMES FRANCIS.

Carbondale, Pa.

Let Us Have Clean Flues.

I will now say a little on pumping. I think Mr. A. G. Kinyon need not use the term "old-timer" any more, for the old-timers, as he calls them, have had to grow up with the new style of things and know both ways.. Start a "new-timer" out with one of the engines we ran thirty years ago, with none of the modern improvements. They would have their hands full. I think Mr. A. G.'s style of pumping all right—with the exception of using the second injector. I think that belongs to the old-timer. When we had no injectors we had to use both pumps, after running water down to get up a hill, for fear we would be stopped or have to take siding. Then the pump stopped. Not so with the injector; I have never run an engine yet that needed both injectors, and very seldom the full force of one. The less you contract and expand your boiler and flues the better and safer it will be for both. It is true, they blow out the boiler while hot and fill it up with cold water and clean the boiler; but the boilermakers examine the flues and touch them up if necessary before lighting fire in engine. That only occurs once in about every two weeks; but to keep contracting and expanding all day will certainly wear them ut. Now, I think one of the greatest troubles with engines steaming and the making of too much steam is that the flues are not properly kept clean. We have the arch behind and the diaphragm in front, and how can the flue be cleaned!

It is true, a man gets on the engine, after it has been hostlered and put in the roundhouse, to clean the flues; but that is only a farce. The tender is loaded with coal and he cannot get the flue rod in the furnace without bending it, and sometimes gets down without getting at flues at all; and if he does get at some of them, he will not get more than 8 or 9 inches from the flue head. Often in going through the shop I see an engine that is laid in for repairs, with the front end off and two men with a rod and maul opening flues that have been stopped up—no telling how long. Now, if diaphragm was removed every 400 or 600 miles that an engine makes, and the flues cleaned properly, I think we would have more steam and less smoke and use less coal.

The way it is now, we have to run the water down and rake and scrape to get up a hill, then use the blower and injector down hill to get ready for the next pull, with smoke beating down on the train. About two years ago we had regular engines. I had a good one and a good fireman, but the engine got hard for steam. I could find no cause for it. They went through the form of cleaning the flues every trip. We went out one morning on the heaviest train we haul, and the engine kept very hot, and popped often on a 17-mile grade of 115 feet to the mile. I thought sometimes my injectors had failed; but not so. We got to the top of grade with engine hot and boiler full of water. My fireman told me the boilermaker told him he had done something to make the engine steam, but would not tell what it was. I found his helper two or three days after that, and he told me, as we had the boiler cleaned and arch renewed, they went in the furnace at 11 P. M. and mauled flues until 2 A. M., and opened 107 of them. And, as long as we had regular engines, after that I had the fire drawn every 600 miles and had flues cleaned, and had no more trouble for steam. We are all making the run, and when one doesn't do his part it comes harder on the next fellow. DAVID LINN.

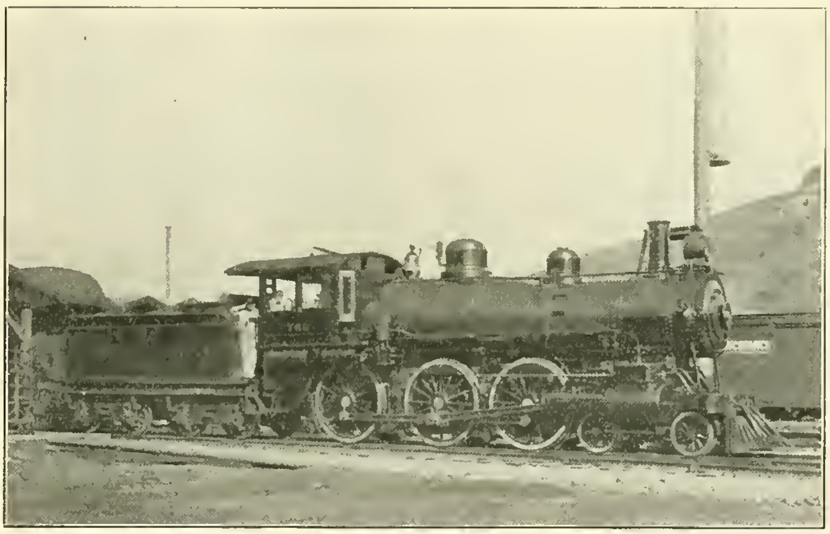
Cumberland, Md.

Boston & Maine Ten-Wheeler.

I enclose a photograph of one of the Boston & Maine Railroad standard ten-wheel engines. As I have never seen any in your paper, I did not know but it might interest some of your readers if you care to publish it. C. E. SOMERVILLE.

St. Johnsbury, Vt.

[It will be noticed that no maker's name-plate appears on this engine. This road removes them on receiving the engine.—Ed.]



BOSTON & MAINE TEN-WHEELER.

Grate Surface.

We rarely hear an engineer recommend increasing the size of the cylinder on an engine, but we often hear the remark ,"If she had a larger grate surface I could run a bigger nozzle in her."

Everybody knows that if the cylinders are so large they cannot be supplied with steam at maximum pressure, the service of the engine is unsatisfactory, and anyone who has ever run an over-cylindered engine will vote it "No good." It is not only a poor steamer, but a decidedly slippery machine. There is no need of further comment as to its faults, they being too well known to require it, but there is need of some light on the subject of grate proportion, in order to show that it must also conform, within certain limits, to other parts relating to it, just as the cylinders must be proportioned with a regard for the capacity of boiler and adhesive power of engine.

A proper area of grate is that through which the exhaust force will draw enough air to supply the necessary amount of oxygen to the fire, and in such a manner that the force of the air circulating through the fire will mildly agitate it, thus keeping it in such condition, when skillfully fired, that the air is strained through it in a way to effect a most complete mixture of air and gas, and at the same time maintain an intensity of heat in the firebox sufficient to consume this mixture of air and products from the coal. If the grate surface is not large enough, the force of circulation through the fire is too violent, causing cold currents of air to pass through it in spots where the grates have become comparatively bare, besides carrying unconsumed particles of coal into the front end and to the atmosphere.

If the grate surface be too large, the draft force will be correspondingly weak, the quantity of air drawn through the fire will not be in proportion to that amount of grate area, and the sluggish circulation will not agitate the fire in a manner to cause a complete intermingling of the air and gas, but will permit it to bake and clinker, cutting off circulation through some, while making it too violent in other parts, and there is also lacking that high firebox temperature so essential to a reasonably perfect combustion.

Another feature closely related to the subject under discussion is firebox design. It is a well-known fact that the firebox sheets, especially the crown sheet, affords the best heating surface, and it seems wise to so design the firebox that the proportion of its heating surface to that of grate area would be such as to most fully utilize the heat produced within it.

To illustrate the point aimed at, we will take two extreme designs of firebox—the first 8 feet long by 2 feet wide, the second 4 feet long by 4 feet wide. In both of these fireboxes the grate surface is the same (16 square feet). The force of circulation through each would be equal, the coal-consuming capacity of each would be approximately the same, but the crown-sheet surface of the oblong type would be 32 square feet, while that of the square type would be only 16 square feet. The writer is not unmindful of the possibility of the grate surface in the 8 by 2 firebox not being sufficient to maintain the required temperature in such a large firebox space, but it must be conceded that the oblong type is an approach in the right direction. A higher temperature would be assured in the square type, but the heat would not be used so advantageously, owing to the comparatively small heating surface it contains.

Another noteworthy feature in favor of the oblong type, and one which will be appreciated by the practical man is the greater facility it affords the fireman to feed the fire properly. A skillful fireman, as a rule, fires lengthwise of the firebox, scattering each shovelful the full length of the grates on either side, or down the center, as required. The whole fire is always in direct line of his vision, and is for that reason the more easily kept in condition to obtain the best results.

The sizes of nozzles are usually regarded as something closely related to the question of steam production, and they are too often restricted in size to make up a deficiency that might be traced to faulty proportion of grate area or firebox design. Area of nozzle opening should be determined with regard for the capacity of cylinders only, being the proper size when they allow the exhaust steam to escape freely enough to avoid excessive back pressure.

Thos. P. Whelan.

Bellevue, O.

Pack Hardening of Steel.

BY E. R. MARKHAM.

The subject of hardening and tempering steel and the case hardening of iron and steel is very interesting to all mechanics.

In attempting to learn to harden steel we should first learn the nature of the piece of metal we have to handle. In ordinary open-fire hardening, there are nearly as many ways of going about the work as there are brands of steel; but in treating the steel by the method known as *Pack Hardening* this is done away with to a great extent.

In hardening a large piece of work it is neccessary to get a uniform heat, not only on the surface, but all the way through the piece. With the open fire this is very difficult, but by pack hardening it becomes simple. If properly done it increases the strength of the material and gives a much harder and at the same time a much tougher surface. I have hardened milling-machine cutters by this process that have run at nearly double the surface speed of cutters hardened by the open-fire and water process, and they stood about four times as long without grinding. For the hardening of taps, reamers, screw-machine dies and all similar tools, where a hard, tough surface is required and it is essential that they retain their shape as nearly as possible, this method is invaluable. I have hardened punch-press dies by this method 12 inches long, 10 inches wide and 1 inch thick, cut out inside in all conceivable shapes, and not have it go out of shape so that it was noticeable by the templet. I have hardened not one, but dozens of these one after the other and had them come out of the bath so nearly as they went in that they would show no rock on a surface plate either on bottom or edges.

The necessary appliances are an oven for heating the work; boxes to pack the work in; a quantity of granulated charcoal; some granulated charred leather for tool steel, and granulated raw bone or other similar material for iron or machinery steel. But never allow any form of bone in any quantity, no matter how small, to come in contact with tool steel if you want good results.

I prefer an oven burning oil or gas if there is work enough to warrant going to the expense of putting in such a plant; if not, some form of coal oven where the coal does not come in contact with the pots or boxes holding the work, as it destroys them very rapidly; sometimes the first time in the oven they will go all to pieces.

If only a limited amount of work is to be done, say 150 to 250 pieces per day, I should put in a charcoal oven, make the outside walls of cast iron, line with fire brick, leaving an air space all around between bricks and iron, have grate surface cover the whole bottom of furnace to insure an even draft, which means an even heat, have your oven smoke pipe connect with tallest chimney about the plant if this is possible, have a damper in the pipe, and if you use charcoal have a damper that can be closed perfectly tight.

The boxes or pots that are to hold the work should be of cast iron at least three inches larger each way than the work that is going in them. It is best to have quite a number of these of different shapes and sizes. Each box should have a cover about one-half inch smaller each way than the inside of the top of box.

For use in packing work, charcoal is the all-important article. If you can buy it granulated, so much the better, as it is cheaper to get it in this condition than to pound it and sift it yourself. Then the article you buy is very much better as you can buy it ground in any size kernel you wish. You will need a quantity of charred leather for use in hardening tool steel. You will also want some granulated raw bone for use in case-hardening machinery steel and iron. There are other packing materials that have their special uses, but they need not be mentioned now.

For the baths (I say baths, as we shall need several different kinds) you need a tank of clear water with an inlet at the bottom and an outlet near the top. You need a tank of brine, and also a tank that has a steam pipe connected with it or some other way of warming it, as there are many jobs that should not be plunged in a cold bath. A tank of raw linseed oil is also needed. If we have much hardening to do in this bath, we should have a rotary pump attached to it in such a manner that the oil will be taken from near the top and pumped through a coil of pipe in a tank of running water and returned to the bath, thus keeping it cool at all times. I do most of my hardening in the oil bath.

Assume we have a punch-press die 8 inches long, 6 inches wide, 1 inch thick. We take some iron-binding wire passing several times through the opening or some hole in the die, twisting together and leaving long enough to hang over the edge of pot. We then put enough granulated charcoal in bottom of pot so that the die will be about half way between top and bottom of box. The box, by the way, should be at least two or three inches longer and wider than die. Mix an equal quantity of granulated leather and charcoal together. Put about one-half inch of this mixture on top of charcoal. Put in die face down, then fill with mixture to about one-half inch above die, fill balance of box with powdered or granulated charcoal, tamping down softly. Put on cover, which should have three or four quarter-inch holes drilled in center. In these holes we place some pieces of about 3-16 inch soft wire reaching to the bottom of box. The boxes are then sealed with fire-clay and placed in the fire. When you think the box would be heated through draw out one of the wires. If it shows red the entire length, time from then. I find that a box 10 to 12 by 6 to 8 and about 6 inches deep generally heats through in about 1½ hours. If the first wire does not show red, wait about 15 minutes and draw another, and so on until we draw one that is red its entire length. The theory of this is, as can be readily seen, the work does not commence to take carbon until it is red hot.

A die of the size mentioned should be left in the fire at a low heat for 3½ to 4 hours after it is red hot. At the expiration of this time, the box is taken from the fire, the work is carefully drawn from it and plunged edgeways into the oil bath and worked back and forth in such a manner that the oil will circulate through the impression in the die. When the work is cold or nearly so, it should be placed over a fire and the strains taken out by slight heating. If the die is weak in any place, it is better to draw the temper to a straw color, but if strong and well backed, it may be left as it comes from the bath after having relieved the strain. A large heavy milling-machine cutter should be packed in the same manner and run from 2 to 4 hours after it is red hot, according to size of the mill, thickness of the teeth and work it is to do. Harden in the same manner as described, only it should be worked around in the oil in such a manner that all the teeth will be exposed to the cool oil. Swaging dies and similar tools should be run from 3 to 6 hours, according to size, simply relieving the strain after hardening, not drawing temper at all.

Small taps, ¼ inch to ⅜, should run about three-quarters of an hour and be drawn to about 475 degrees heat to give the proper temper. Larger taps should be run a longer time; one that is between 1 and 2 inches diameter should be run about 1½ hours and drawn to 460 degrees. Rose reamers should be run a little longer than taps and simply have the strain relieved. As one becomes accustomed to this method of hardening they become more and more a believer in it, and in the oil bath when it can be used. But there are jobs where the oil cannot be used to advantage, as on dies for drop forging. These may be packed in boxes using charcoal alone or putting a small quantity of leather in and around the impression. By the use of the wires through the lid, we can tell very nearly when the work is hot. It should be allowed to run three or four hours, according to size, after the wires show hot, to insure a uniform heat. Then, by proper appliance, it should be plunged face down in the cold-water bath with the stream of cold fresh water coming up against the face from the bottom of the tank. Just before immersing the die, it is an excellent idea to throw a handful of common table salt on the top of the water in bath and to brush out any of the packing material that may adhere to the face or in the impression of the die.

This is the way I harden some of the tools generally used in machine and forge shops. A little study and common sense will soon show anyone how to harden any tool by this process.

When I have several hundred pieces to harden at a time, I keep a tank of boiling water near me and plunge the articles into this as soon as they are hardened to relieve the strain, which it does very effectually unless they are very thin pieces, like metal-slitting saws or similar articles which are liable to crack. I usually leave these in the bath until I am ready to draw the temper, which I do in hot oil, using a thermometer.

I had intended to write something about case hardening of iron and machinery steel, both by the regular method and by what is known as the Harveyizing process, but will leave that for another time.

Railroading in 1935.

BY R. E. MARKS.

I went down to the roundhouse the other day to get ready to go out on the fast freight, and somehow things didn't look right. There was the "19" standing there, but she looked different—wasn't any dome in her, stack looked a trifle larger; front-end extension was gone, and the boiler was smaller. Funniest thing of all, there wasn't any tank at all, and the cab was at the front end. Cylinders were out of sight, like an inside-connected engine, and the smoke arch seemed to round down like the English engine. The longer I looked the more befuddled I got, and my fireman seemed to look at me as though he thought I was full of Jersey lightning. Wasn't any cab at all at the back end, and I finally asked him where in thunder he kept himself on that new engine and where the old "19" was.

"New nothing—same engine we've had for three years. What's the matter with you anyhow, Marks—thought you were a prohibitionist, but I'll be hanged if this looks like it. But I won't give you away. Climb in the cab there and I'll run her. You watch for signals, and we'll get along all right."

So I climbed in and sat down, wondering what was coming next. Cab at the front end was a decided novelty to me, and this one had things fixed up in great shape; Stannard's spring seats and lots of room besides—not much like the big boiler engine I remembered.

The reverse lever looked natural enough, but instead of the throttle there were two small levers, marked "oil" and "air," coupled together, yet each could be varied still moving together. The brake valve seemed about the same, but there wasn't a sign of a fire door, or an injector either. I began to think the fireman was right; but as I hadn't even smelt a ginger-ale bottle that day, it was unaccountable. Just then he climbed into the cab. "Well, we're ready, Marks, and you look as wild as a Fiji Indian. Just keep quiet and we'll get out of this before the Old Man finds it out Got a match?"—and he took a small torch tube as I handed him one, and lighted it. Then he shoved it in a hole. "Guess I'll warm up the air a little this morning; kinder cold, and she'll start better. Turn on that spark switch now, will you, Marks? Say, what in blazes ails you anyhow? Don't look as though you knew what a spark switch was, and you've been running this engine for three years. Must be some of your wheels have slipped a cog or two," and he tapped his head. "Well," to himself, "I'll have to humor him if he is daffy. Guess I'll make out he is brand new and never saw an engine like this before. I'll tell him about things.

"I heated the air with that torch you saw. This spark switch lights the charge of oil and air, and the engine starts—see?" and I heard the machinery start under the engine.

"But the engine isn't moving."

"Course not." Then, to himself, "Crazy as a bed-bug—haven't thrown in the clutch yet. That's the beauty of these oil machines. Signal's right now, so here we go," and we moved out into the yard and were coupled on the train. Fireman kept busy getting things in shape for the run, and not paying much attention to me. First he shoved a kind of a thermometer into a hole in the boiler. "Specific gravity 78 points," he said. Consulted a plate cast on the boiler-head and adjusted his "air" and "oil" levers. Machinery running all the time under the engine, while we waited for signals. Got them at last, and he throws the reverse lever forward, and we start.

"Low-speed gear in now," he says. "Now I'll give her a little more fuel," and he opens the throttle wider. "Pretty soon we'll use the higher gear," and he moves the lever forward two notches. We pick up speed immediately. Nothing to do now but ask questions; so I begin.

"Say, Jim, tell me all about this. Where's your coal, where do you fire, and what did you jam that thing in the boiler for?"

"Coal?—why, we haven't used coal in three years. This is an oil engine. No firing about it either. The front of this boiler is an oil tank; back part is water for jacketing the cylinders. We mix oil and air and ignite it in the cylinders—gas-engine fashion. Don't use steam at all. Great institution. Machinery runs whether we move engine or not. Clutches look after that, and let us vary speed as we please, while engine itself—underneath—runs the same. Then we vary that, too, by the sparking device, and get a wide range of speed.

"Now I'll open her up wide," and he shoved the lever away forward. Pretty soon he moved a spark lever, as he called it, and we were humping along at a great rate.

"But what's the use of changing from steam, Jim? Wasn't it good enough for anyone? There wasn't so much to look after as here."

"Wasn't, hey?—well, your forgettery must be working overtime lately. What about firing, using injector, watching steam gage, trying gage cocks, etcettery? Then this is cheaper, too. They've got these oil engines so that coal isn't in it—cost four times as much; some say more. Then there isn't any firing, evaporating water, using the steam and exhausting it. Biggest thing that ever happened.

"I thought one while the electricity chaps were going to make motor men out of all of us with their old coffee-mill controller boxes. But the oil men saved the day for us. These cost so much less to operate that the company don't mind two men to an engine. Have to have them for safety anyhow. Well, here's Summit, where we switch out three cars."

He handled his reverse and air just as I used to, first closing throttle almost shut, so as to leave the machinery running slowly.

"How about starting away from here," I asked.

"Just watch. Now"—and he opened his fuel feed more than before, then he threw in the lever gradually, and she started in great shape.

"How about heating passenger trains?"

"Dead easy. Just turn the jacket water back through train pipes. Cools the water and heats the cars. No trouble at all. And the exhaust, you see, isn't disagreeable as with steam. Subdivided so, it's soft. I've been thinking of rigging up a chime in the stack, so as to have music as we go along."

"But"—just then something caught me by one arm and pulled, and Mrs. M.'s melodious voice remarked: "Rube, the next time you go to the New York Railroad Club you better stay there till the next day. I haven't heard a thing but oil engines, specific gravity and perfect combustion ever since you struck the bed."

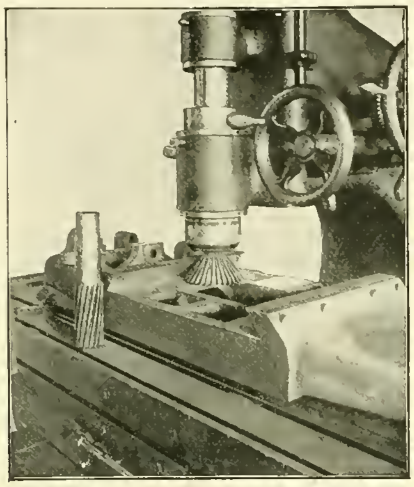
So I'd been dreaming after all. But the more I think of it the more it seems like a vision instead of a dream. After what Mr. Secor told us about oil and oil engines, I don't know as I wonder at my dream.

[A few of Mr. Secor's remarks were used last month, and we don't wonder Mr. Marks was impressed.—Ed.]

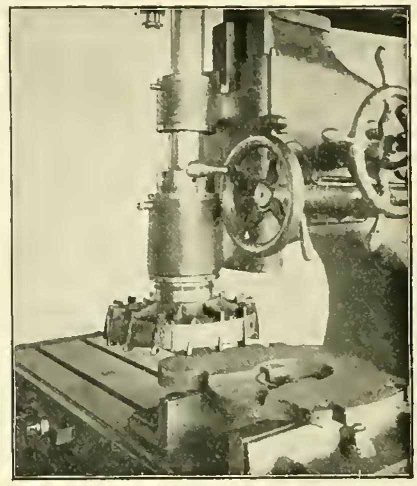
The Milling Machine for General Work

Most of us who have not been in the shop for a few years are apt to think of a milling machine as a tool on which to flute taps and reamers and to do such duplicate work as can be handled by a formed cutter. But the milling-machine field has broadened until we find the vertical miller doing work on which we always supposed the lathe had a first mortgage, as well as work formerly done by a planer.

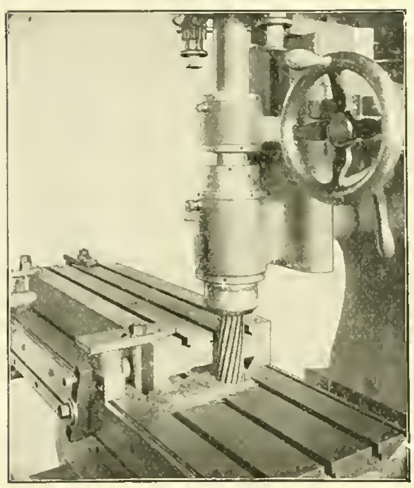
This is very neatly shown in a little booklet, called "Object Lessons," recently issued by the Becker-Brainard Milling Machine Company, Hyde Park, Mass., and we reproduce a few illustrations from it. The captions give about all the description necessary; and for the saving in time over lathe and planer, we would refer readers to the booklet before mentioned, which will be sent on application.



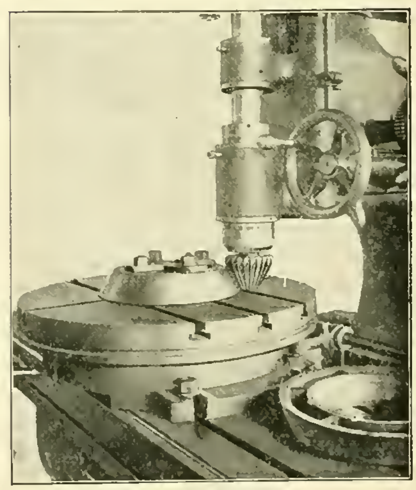
SURFACING AND FORMING AT ONE SETTING.



SURFACING CUTTER AT WORK.



MILLING END OF BED.



ANGLE MILL DOING LATHE WORK.

A Wise Mule.

The Sinclair Construction Company is operating a big stone quarry at Ullin, in Southern Illinois, taking out stone ballast for the Illinois Central Railroad. In carrying on the work, they employ a large number of horses and mules, and some of the latter have displayed wonderful sagacity. There is one mule in particular which hauls cars a considerable distance without a driver. A man at the end of the course hooks the mule to the car and away it goes to the other end where another man unhitches it and couples it to a return car and the mule keeps up this routine all day.

As this mule is of very steady and punctual habits, the man at the end of the course was very much surprised one day to see it elude the hitching operation and gallop away towards the smithy. Arriving there it turned into the horse-shoeing stall and held up one of its hind feet on which the smith found a loose shoe. He proceeded to fasten it, and by the time that job was done the man in charge of the mules arrived to capture the animal which took leave without permission. As the smith finished with the hind foot, the man took the mule by the head intending to lead it back to the quarry, but it jerked its head away, turned around and held up a forefoot on which it was found there was another loose shoe.

Since that time the men in charge pay no atention to the shoes of that particular mule. When they they see it elude hitching to the car and gallop away towards the smithy they know that it is needing the services of the mule shoer.

On the Central New England Railroad.

After traveling the beaten paths of trunk lines for months and years, it is a relief to get on to a road which is new to us, even if old in years of operation. Leaving Hartford on the Central New England, we strike northwest through the Nutmeg State, and between here and Simsbury find about the only level portion of the road.

From Simsbury it is more west than north, and as the mountains in Connecticut run approximately north and south, the natural result is a series of grades which give fine scenery, even if the hauling capacity of the engine is limited thereby.

At Tariffville the new line to connect with Springfield branches off, and the beauty of the spot is seen in the view from the station, showing the new bridge over the Farmington River.

Collinsville is reached by a "Y," as it is not quite on the main line of the road, and is a pretty little town lying close to the Farmington River, which is fringed with trees and dotted with various small islands.

A few miles beyond here we cross this river in a narrow gorge, where rock-ribbed mountains rise on each side and the bed of the river is so narrow that it retaliates at times by flooding the country above. This is called "Satan's Kingdom," and anyone who enjoys wild scenery would be inclined to make the old boy's acquaintance for a chance to visit him in such a place as this. Strange how some of our most beautiful scenery should be mortgaged to his satanic majesty, by name at least! It does him credit in the taste shown in selecting such beautiful spots for an abode.

New Hartford is a pretty New England town, and they tell me the best tobacco for cigar wrappers comes from this section. Not being a judge, I take their word for it—easiest way anyhow. At any rate, it is fine-looking tobacco, as it grows to almost the height of a man, and the rich green of its leaves gives a pleasant impression to the eye.

Winsted, noted for its clocks and pins, is a busy-looking place, and as the hard climb to Norfolk is now before us, Master Mechanic Schaefer and the J. P. go to the engine for the climb to Summit, and Norfolk just beyond.

This is an 11-mile climb, with the grade varying from 66 to 100 feet to the mile—4,000 feet of the latter, and the many curves add to the train resistance. Engineer Jones and Fireman Sisson seem to understand each other's ways, and though the engine is barking away steadily as it climbs up—up—up, the steam hardly varies, but hangs around the 135 mark as though it was glued there.

The one-shovel method was used entirely, and is, I understand, on the whole line, and the steam was certainly kept up where it belonged. There was very little smoke either—just a whiff after each shovelful, as the engine was working hard enough to draw the finer particles of coal through the flues before they got fairly warm—not to mention complete combustion.

Mr. Schaefer uses the Master Mechanics' front ends without netting, and they throw practically no fire. But they clean their front ends themselves, which is the object sought. This engine was an 18 x 24 Baldwin, with a nozzle 4¾ inches in diameter, and from all appearances was doing fine work. C.

NEW YORK, NEW HAVEN & HARTFORD BRIDGE AT NEW HARTFORD, CONN.

BRIDGE OVER FARMINGTON RIVER AT TARIFFVILLE, CONN.

More Railroad Reminiscences.

BY WALTER S. PHELPS.

When war was being waged between the North and South, it became necessary to use rolling stock of our Northern railroads to carry supplies and troops into the Southern States. Locomotive builders had to build for the government, to the exclusion of the railroad companies, which crippled our Northern roads more or less severely, so much so that to meet the government demands for transport, engines and cars of all classes and designs (a motley group) could be often seen on twenty minutes schedule time, train after train, following in succession in one or the other direction. The writer was often on one of the miscellaneous number, until called off for shop service.

It was during these times our State

(Indiana) had over 280 lodges of the secret societies in aid of the South (the Sons of Liberty and Knights of the Golden Circle), headed by prominent politicians and believers in a disrupted union. War Governor Oliver P. Morton, being in office, was watching these partisans, and, determined to make a coup, ordered arrests to be made. His aide de camp, Alvin P. Hovey, was in Columbus, Ohio, and at 3 o'clock one morning the writer was called to make a hasty trip to Indianapolis from Columbus, Ohio. Upon leaving, an officer came to the engine and desired to ride.

Not knowing who he was or the nature of his business, we left as soon as possible. Before we arrived at Indianapolis about 11 o'clock, I learned that important arrests were ordered to be made. General Henry B. Carrington was to make them, and by preconcerted arrangement the person directing this order was the officer upon locomotive No. 8 (a Baldwin), and no less a person than General Alvin P. Hovey, of Indiana. At Indianapolis from the "Sentinel" office I witnessed three dray-loads of arms, labelled "Sunday-school books," taken to the barracks at State House yard at this time. Arrests were made of persons named: Bowles, Milligan, Heffner, Dodd, Horsey and others, who were tried afterwards for high treason, convicted and sent to Columbus penitentiary for safe keeping.

Just before this event, while in Canada, boarding at the Hirons House—William Hirons, proprietor—I had at the table such notables as Beriah McGoffin, governor of Kentucky; Major Glass, of the Confederate Army, who made his escape from the Union camp where he was a prisoner, and Clement L. Vallandigham and his son. "Hot times" were these among the different adherents of opposite sides. It was during these times the modern "pop steam valve" was invented. Its author was a vise hand in the shop at Indianapolis—his name, Robert Mood. He lives to-day in Topeka, Kansas, and is a plumber and gas fitter. He got it patented and sold it for a song almost to a Mr. Richardson, who made a fortune with it or out of it. The first one ever made was constructed at the railroad shops of the old Indianapolis & Cincinnati Railroad. This was placed upon Engine No. 20, James Watson, engineer, who is still running a locomotive for that company (now the Big Four).

I will send you later a "first tracing" of the Mood valve, as was placed upon the No. 20 in 1864, from actual drawing, with the apparatus for compressing the spring to any tension desired by the engineer after the valve had been set to its utmost limit allowed by the master of machinery.

A great many of the locomotives around Cincinnati and the West were Niles, Moore & Richardson, Cincinnati, Ohio; Palm & Richardson, St. Louis, Mo., and Rogers, also Swinburne, of Paterson, N. J.

The Niles was fast, and was the first to adopt the long steam port. Some of these ports exceeded the diameter of the cylinder 2 inches or more by 1/4 inch with 2 3/4 inches exhaust opening and 7/8 inch to 1 1-16 inches lap of valve. The valve motions were suspended from a table hung below the frames, the rocker arms being in the usual place in pillow blocks over top frame. There were also some Thatcher engines, built after Ross Winan's camel designs, with the fireman in the basement and the engineer in the second story, a flight of steps being between made up mostly of heavy castings unfinished and unsightly.

The writer built five straight-link engines in the States and Cuba that gave excellent service—two were inside connected, the balance outside connected, of which I retain most of the drawings as well as the model (motion work) from which the dimensions were taken. It was while on duty on the 14th of April at about 9:50 o'clock that Charles H. Sommers, electrician at the shops, was notified to connect Associated Press wires (the line passing through the shop office), and it conveyed the news of the assassination of President Lincoln.

None of us slept that night, for the city (Indianapolis) was in an uproar and blood was at a white heat, every man armed and showing his colors. We all knew the desperate character of many of the Indianians and others who were sojourning here from the more Southern States. Crowds were to be seen on all streets in earnest conversation and a determination to wipe out some characters in that city should any attempt be made to palliate the crime.

ENTRANCE TO TARIFFVILLE GORGE.

The Newton Machine Tool Works, of Philadelphia, are now fully installed in their enlarged works, having about double the capacity and, with the new tools, fully three times the capacity of their old works. They report the prospects for business are very good, especially so in the order of heavy tools and portable tools. They are now designing a very large milling machine for the German Government, which will weigh about 150,000 pounds; and among the novel tools which they are now building is a portable rotary planing machine for the Southwark Foundry Company, Philadelphia, and also one for the E. P. Allis Company, of Milwaukee. Both of these machines are driven with a motor and can be used in any position on a bed plate. The machine for the E. P. Allis Company is the third portable rotary planing machine which they have furnished them. They have just issued a new catalogue, which should be in the hands of all who want to keep posted on modern tools.

Sunlight is white light; all else is colored. Even our electric light, which is nearest to perfection, is not pure white light. The light of the sun has in composition all colors, for if a beam be passed through a prism, there will appear on the screen in regular order the colors of the rainbow most beautifully blended. The prism simply tore the sunbeam apart and scattered its component parts. So sunlight is the sum of all colors. As we let one color after another enter a ray of light, the effect is whiter light, for if the rainbow be sent back through the prism the result is the original white ray.

Our friend Barrett informs us that the locomotive we illustrated on page 425 of October issue was not a Mexican Central engine, but belonged to the Mexican & Vera Cruz Railway. It was built by Neilson & Co., of Glasgow, Scotland.

Smith & Perkins' Last Type of Locomotives.

BY C. H. CARUTHERS.

Up to 1856 the Virginia Locomotive Works of Smith & Perkins, at Alexandria, Va., had been building freight engines of a type in which six driving wheels, 44 inches diameter, and a pair of 30-inch leading wheels were placed as closely as possible together between the cylinders and the firebox, the leading wheels having their boxes set in rigid pedestals, like the drivers.

The pumps were placed behind the drivers, and were driven by a return crank attached to the rear driving pin.

A few of the first of the Perkins engines had the frames end at the front of the firebox, after the manner of the Ross Winans camel engine; but all the later ones had the type of frame change from bar to slab at the rear driving box, and thence carried it to the rear of the firebox, where it met a cross-frame containing the jaws for coupling to the tender. Drop-hooks and half-stroke cut-off were used on all, and branching "buckhorn" safety valves on an independent stand, on many.

In April, 1856, the firm built three engines differing materially from those just referred to. A four-wheel spread truck was used instead of the single leading wheels, and the drivers were somewhat separated. The axle of the rear pair was placed beneath the firebox, which was made much shallower than on the earlier engines, and while the pumps were still placed behind the drivers, the return crank which drove them was placed on the main driving pin (second pair) instead of on the pin of the third pair.

The valve motion was the suspended, or "Gooch," type, and as these links were forward of the first driving axle, their radius rods uniting them to the rocker necessitated the use of a very short valve rod.

The guides were of single-bar diamond type. Cylinders and dome were jacketed in brass, and bands of brass secured the Russia-iron jacket of the boiler.

The boiler was of wagon-top type, with dome about center of waist and whistle on front ring, on a column, around which a circular sandbox, slightly dished outward, was placed.

The safety valves were on the dome cover, and over them was placed a neat hemispherical cover of brass, surmounted by an escape pipe of the same material.

The bell hung in a frame of brass, and was placed in front of the cab on the wagon top.

The name was formed of raised letters of brass, upon black plates bordered with half-round strips of brass. These name-plates were fastened to the sides of the boiler.

Four inverted half-elliptic springs, two on each side, carried the principal part of the weight. The many driving-boxes carried spring posts, which extended above the frame, and on each of these posts the one end of each spring on that side rested, and the other ends rested on posts rising from the boxes of the third and first pairs of drivers.

The four-wheel truck was of the Bissell type, with spring equalizer above the truck frame. The driver springs, owing to manner of receiving the thrust, had bands nearer the third and first boxes than the central one. These bands extended below the spring and entered jaws attached to the frame, and were held in place by pins extending through jaws and bands.

The cowcatchers were of rods of round iron running from the bumper downward to a frame at the bottom.

The tenders were of ordinary pattern and had the regular Perkins trucks, consisting of a wooden sill on each side of each truck to which the journal boxes were bolted. These sills were united by a plank crossing from one to the other at the bottom, and by two cross-pieces at the top. These three pieces were between the wheels. The springs were large disks of solid rubber, and rested upon the plank, while a loose bolster was placed between the upper cross-pieces and rested upon the springs in the usual way. It also had the center-plate and side bearings on its top.

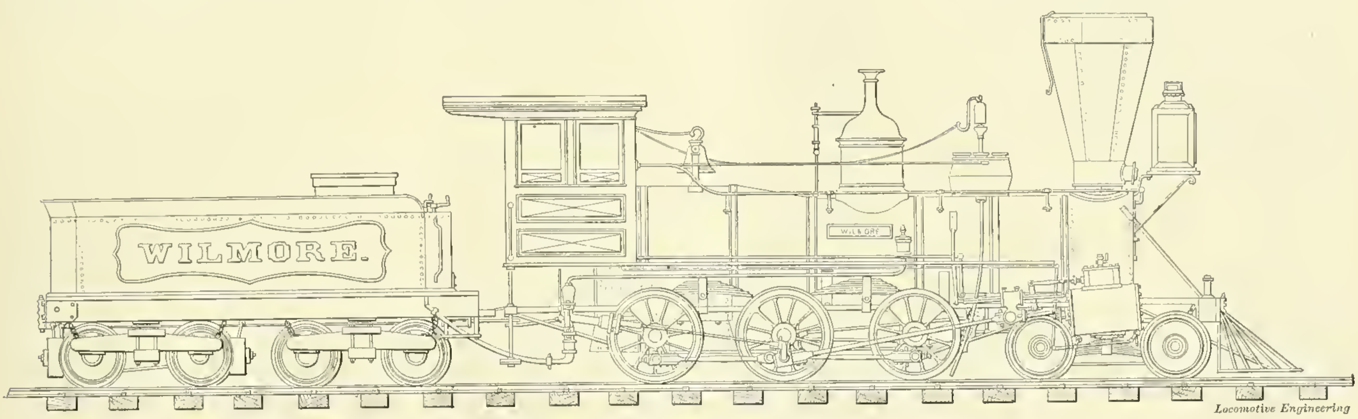
The brake beams were suspended from the frame of the tender on the outside of the wheels, and had large wooden brake blocks instead of iron shoes as now used, and but one truck had a brake.

The weight of these engines was 60,600 pounds, of which 44,400 pounds were on the drivers.

Vermilion was the color used on cow-catcher, wheels, dome-base, sandbox, cab, tender cistern and frame. The tender trucks were painted in terra-cotta; and the name was on the cistern sides in white letters, and was surrounded by a line of flowing pattern.

The three engines referred to were built for the Pennsylvania Railroad, and were called "Wilmore," "Cresson" and "Gallitzin." When numbers were adopted, a year later, they became "127," "128" and "129," respectively.

In 1858 the "Wilmore" was leased to, and in 1857 the "Cresson" and "Gallitzin" were sold to, the Steubenville & Indiana Railroad, now a part of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway. They continued in service for a long time on this road. One of them, the "Wilmore," I believe, received the name there of "Mingo Chief," which it retained until numbers were adopted.



SMITH & PERKINS TEN-WHEELER.

It would almost seem as if these were among the last engines built by Messrs. Smith & Perkins. No others from them seem to have been placed on Northern railroads, and my next knowledge of Mr. Perkins was his name as superintendent on the badge-plate of some engines built at the Lancaster Locomotive Works, in 1866, after Norris Brothers took charge of those shops; and later he is mentioned in connection with the Louisville & Nashville Railroad, and then within the last five years his death, as the result of a fall on the streets of Baltimore, is recorded.

A curious incident happened lately at the Hudson County (N. J.) insane asylum. There was an exhibition given there of the working of a biograph for the entertainment of the inmates of the asylum. One of the pictures showed the Empire State Express rushing, as it were, towards the audience. The lunatics seemed to have good care of their personal safety, for a sudden panic ensued, and the whole body of the inmates made for the hind end of the hall.

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Failures and Successes of Apprentice Systems.

Many efforts have been made by railroad companies and manufacturers to increase the number of apprentices in their shops and factories; but the measure of success achieved has been very small considering the earnest efforts made. Systems of training have been introduced which would enable the apprentice to learn the trade under some instruction and supervision, instead of leaving him to acquire skill, or not, just as natural ability existed and inclination dictated. The rules would be closely adhered to for a few months and then permitted to fall into disuse. In connection with some manufacturing concerns night-schools were established for the benefit of apprentices, but many of these, too, have proved a failure. It appears to us that the character of existing industrial conditions is against the apprentice receiving proper training through all branches of a trade. Work in our shops is so finely specialized that it is difficult moving a boy to a new operation when he has learned to be skilful at another. Self-interest and the grim tyranny of competition induce the employer to keep each apprentice on the operation where he can turn out the most work. This is a national misfortune, but it is impracticable to make manufacturers public benefactors, unless they are inclined that way. They have been so much accustomed to obey the grim laws of supply and demand, that they are excusable for applying the same principles to their business.

Why the evening schools instituted for the training of apprentices in school education and in the scientific principles underlying their business, should receive so little support from those most interested, is not easily understood. The splendid success of the International Correspondence Schools is a direct proof that workmen and apprentices are anxious to learn and are willing to pay for the lessons. It may be that our spirit of individual independence goes so far that our people have a distaste for accepting favors they do not pay for. Publishers who have a large "free list" are annoyed by this sentiment, for they are aware that free papers are very seldom read.

The efforts of philanthropists in Europe to induce workmen and apprentices to attend evening schools for acquiring information concerning the principles of their business, are far more successful than they are here. This success may exercise an important influence on the race of competition in future. Germany is dotted with scientific schools for the training of workmen; Belgium is not far behind; the educational authorities in Great Britain are striving hard to give free scientific education to every man and woman who will accept of it, and even France, which has never been noted for giving educational facilities to its people, who claim to be held together by the embracing ties of liberty, equality and fraternity, is moving energetically towards popular industrial education.

French railway companies have led the cause of popular education, and their example has exercised a stimulating influence on the nation at large. All the leading railways provide for the teaching of the elementary branches of education to their apprentices; the idea being that that training will increase the value of the workmen.

The Eastern Railway of France appears to take the lead in this educational work, the scheme having been worked out by M. Eduard Sauvage, a well-known author of engineering works, who was for several years locomotive superintendent of the road. There are in the works about 250 apprentices, the system having grown gradually in fifteen years. In this, as in nearly all cases, the sons of workers have a preference, and a small salary is paid, beginning at 1 franc a day at the Paris works and 50 centimes in other places; but there may be increases every five months of 25 centimes at a time, according to the services that the apprentice is capable of rendering. The apprentices, after learning some rudimentary ideas of handiwork, are placed in the different workshops, under steady bosses, who are practically their teachers. The theoretical instruction includes reading, writing, history, geography, arithmetic, geometry, design drawing, elementary physics and chemistry, technology, mechanics, outline drawings and parts of engines. In the engine shops at Epernay, the first part of the practical education is the use of the file, chisel and hammer, the making of simple parts, rules, screws, keys, squares, etc., and after a year the apprentice passes on to setting up, fitting, boiler-making, or the smithy; but during the third year all apprentices are sent for at least two months to the smithy, there to learn to work hot metals. The school education lasts four years, from October to the following August. Every year the two most deserving fourth-year pupils go to the lathe, and another to the drawing office, getting 2 francs per day.

Why we are Beating European Manufacturers.

When anything happens which takes away sources of income from an individual, a company or a nation, the change is seldom regarded philosophically or in good-natured fashion. We are therefore not surprised to find that considerable resentment prevails in Great Britain and other European countries because the United States is rapidly becoming a competitor in markets which they formerly considered exclusively their own. Current reports that American manufacturers are likely to fill a good many orders for various kinds of material required to repair the destruction of property caused by the war in South Africa have led to many indignant protests from British manufacturers. They passionately demand why contracts or orders for material should be awarded to American manufacturers when British producers are willing to supply what is required. The answer given has been to the effect that British manufacturers cannot compete evenly with the United States, either in price or in promptness of delivery. This question of United States manufacturers underselling the productions of European manufacturers grievously wounds the people who have enjoyed a practical monopoly for a century, and might be expected to have perfected methods of production in a manner that would put them beyond the fear of competition from newcomers to the business.

Americans travelling in Europe, if in any way associated with the industrial interests of the United States, are frequently questioned about how it is, considering the high wages paid to all classes of workmen in America, that our manufacturers are underselling their competitors in Europe, especially in the metal trades. There is a decided inclination among British manufacturers to throw upon the workmen and upon the operations of trades unions the blame for the higher cost of production which is responsible for the British manufacturers falling behind in the race of industrial competition.

There may be some foundation for throwing the blame of high cost of production upon the British workman, but from experience and observation in British and Continental workshops, we are of the opinion that the real responsibility for the Americans being able to push the British manufacturers out of their own markets lies in the fact that Americans are far more enterprising and progressive than their rivals.

In every country in Europe, a mechanic is regarded as a sort of animated machine that ought to be well treated, but an entity out of which merely a certain amount of work can be taken by developed manipulative skill, the exercise of brain power having no wage value. If there is anything more than another that the European employers of labor hate about his animated machines, it is to see any attempt to pursue original methods of doing work or the tendency to invent an apparatus for doing operations differently from what has been the practice of shop or factory. A stinging reproof that rings through every shop in Europe is "you are paid for working, not for thinking." God's gift of thinking is dwarfed by every means known to the superintendent, and that policy is considered the proper way to do business. Those who criticise this system are told that the concern employs experts whose business it is to devise the most perfected form of tools and the best methods of production. These experts, of course, are supposed to know more about manufacturing methods than any workman, although they may never have worked in shop or factory.

Since the incipiency of manufacturing pursuits in the United States, every establishment of any consequence has had its expert for devising improved tools and methods, but the work of the expert has been small in comparison with the inventive products of the workmen. The workmen have been always encouraged to think for themselves. There has been every encouragement given to inventive efforts with the result that American manufacturers have enjoyed the benefit of an army of inventors familiar with every detail of the methods or tools they labor to improve, while other countries have to be contented with the small progress starved by the complacent know-nothingness of their experts who usually learn nothing and forget nothing.

The European workman is as ingenious and as fertile in devising improved tools and methods as an American if he has only enjoyed the opportunity of showing what he can do. He never enjoys such opportunities in his native land, but when he comes to America and escapes from the depressing curtailments, when he leaves behind the chill penury which suppressed his noble rage and froze the genial currents of the soul, he quickly falls into line as an inventor. There is a constant tide of this class of mechanic pouring into the United States. His skill and intelligence are doing much to enable our people to gain and hold the place of victors in the race of industrial competition. If the manufacturers in the lands where these people come from had been sufficiently wise in their generation to take the advantage of native talent, they would not now be searching for excuses to explain why they are getting beaten in their own markets.

Trying to Prevent Cylinder Condensation.

Those who are familiar with the experimental researches that have aided the development of engineering science cannot fail to have noticed the great number of repetitions that certain lines of investigation have undergone. One of the easiest ways to find out how frequently expensive experiments have been repeated is to make a careful study of the Railway Master Mechanics' Annual reports and the reports of the various railroad clubs. Some line of mechanical improvement occurs to a man and he begins cogitating about how it can be carried out, and perhaps goes to the expense of procuring a patent to protect an invention emanating from his idea. Then the thing is tried and all sorts of efforts made to achieve success with it, but failure comes instead. After a few years the efforts and patent are forgotten, and another would-be improver makes another trial, with similar results. Success sometimes comes after many failures, as in the case of power brakes, injectors, balanced valves, sight-feed lubricators and other inventions that met with numerous early failures; but that is not the rule.

We have been led to this line of reflection by learning lately of several attempts made to prevent cylinder condensation in locomotives by means of steam-jacketing the cylinders and by superheating the steam. At a recent meeting of the Institute of Mechanical Engineers of England, Mr. Aspinall, general manager of the Lancashire & Yorkshire Railway, and long its locomotive superintendent, gave particulars of a group of locomotives built by the company, which have steam-jacketed cylinders. That is, they have a steam-tight casing around the cylinder through which live steam passes. To ensure the steam always passing through these jackets, it had been arranged that the steam for operating the injector passes through the jackets and could not be shut off. There is no trouble from condensation of steam in these jackets, Mr. Aspinall said, any water that might be formed being immediately carried into the boiler. There are nineteen of the engines arranged in that way, and the twentieth has another improvement intended to still further reduce the consumption of fuel. This boiler has been shortened internally, while remaining to look on the outside like the others. In the extended smokebox thus formed is placed a large superheater. This is provided with tube plate and tubes, the superheater tubes being larger than the boiler tubes, so that the latter might be drawn out through them. The superheater, in addition to the tubes, has three or four diaphragms through which the tubes are passed. These diaphragms are so arranged that the steam has to tread its way up and down between them on its way to the cylinders, thus taking up more heat than would be absorbed otherwise. The results obtained with the steam-jacketed cylinders were reported to be very satisfactory; but the superheater had not been in use long enough to prove what its real value was.

There is in the Paris Exposition a curious-looking German locomotive having a big, oblong box at the base of the smokestack, which contains an ingeniously contrived steam superheater. This engine was illustrated on page 446 of our October number.

There are features about the steam jacket and the superheaters referred to which seem to be novel, and may bring success in lines where many failures have been recorded. There are many steam engines that have used steam-jacketed cylinders for years with highly economical results; but the hundreds of attempts made to apply steam jackets to locomotives have failed, and we cannot see anything in the arrangement for the Lancashire & Yorkshire engines that will insure the invention from the fate that has befallen its numerous predecessors.

The cylinders of a locomotive are so badly exposed to chilling influences that appliances put upon them to prevent condensation may fail when the same appliances used on the cylinders of stationary or marine engines may act satisfactorily. The leading difficulty with applying steam jackets to locomotive cylinders has been that the devices used to keep the jackets drained of the condensed water failed to work properly, and the jacket became in itself a condenser instead of acting to prevent condensation. This has been repeatedly demonstrated experimentally.

Inside cylinders are to some extent protected from condensation by the heat of the smokebox. We have always believed that an efficient means of protecting outside cylinders could be devised by passing a current of the hot air from the tubes around the cylinders. Several attempts of this kind have been made without producing satisfactory results. It may be one of those cases where important points have been overlooked that mark the line between success and failure. The prevention of cylinder condensation effects such a material influence on fuel-saving that trying to produce an efficient system of prevention is a highly meritorious line of engineering endeavor.

Freight Cars have Reached Safe Limit of Weight.

When the introduction of freight cars carrying from 80,000 to 100,000 pounds began, observing railroad officials became interested in the question of what defects were likely to manifest themselves with the immense weight carried on each axle. There was no inclination to put more than two four-wheel trucks to carry each car, and it became an interesting subject of discussion as to what weight four axles and eight wheels would carry safely. For twenty-five years the loads of freight cars have been steadily increasing. With every increase from 20,000 pounds upwards, prophets have been numerous who foretold that the limit of the carrying capacity of two four-wheel trucks had been reached of two four-wheel trucks had been reached; but somehow the weight was doubled and trebled without particular distress being manifested on the part of the trucks, and some people came to think that the increase of weight might go on indefinitely, so long as the parts of trucks and the axles were made sufficiently strong to carry the increase of load.

Experience with the heavy class of freight cars now in use seems to indicate that the safe limit has at last been reached. Contrary to expectation, it is not the truck or the axle that has manifested distress, but the wheel. The action of the tremendous load weight on the wheels is to destroy the cohesive power of the metal and cause breakage of the flange. It does not break under the action of sudden heavy transverse blows, but the metal at the base of the flange becomes deteriorated by the great pressure put upon it; and when this weakens the flange foundation to a certain extent, a large section—in some instances the entire flange breaks off. The worst feature of the case is that there seems to be no remedy.

On one of the leading railroads where the heaviest cars have been largely employed, they have had a great deal of trouble with wheel flanges breaking, and heavier wheels have been introduced with out any improvement being effected. Those who have given the subject close study do not believe that even steel-tired wheels will carry the weight with safety. A railroad official who has had a great deal of experience with the heavier class of cars and is an expert on rolling stock frankly told the writer that he believed the safe limit of weight for cars had been exceeded. and that reduction instead of increase of weight would soon become the order of the day.

Porous Air-Brake Hose.

Several times, in one form or other, has the subject of air-brake hose for railroad service been before the Master Car Builders, and twice has it been discussed by the Air-Brake Association. Each of these times attention has been attracted to the hose because of some failure or shortcoming manifesting itself in service or operation, such as bursting under high pressure or because of deterioration due to kinking and improper hanging. The first objection was apparently met by specifying a pressure test which the hose is required to pass, and the second by allowing the hose to hang free when uncoupled. Whether the two remedies supplied have proved entirely satisfactory and sufficient is not our purpose to discuss, but rather to exploit a third and recently discovered weakness in air-brake hose which is doubtless far more reaching and more important than either of the two apparently corrected shortcomings before mentioned.

The weakness we refer to is one of faultily constructed hose, which permits air pressure to leak and filter through thousands of small holes in the duck and rubber layers, and dissipate. Instead of the rubber being pressure tight, it is only partially so. The hose is porous. The pores are so small that leakage can be detected only by coating the hose under pressure with soap-suds or immersing it under pressure in a vessel of water. In the first mentioned test, the surface of the hose will soon become covered with small bubbles, and in the second, the bubbles will form and finally detach themselves from the surface of the hose and rise to the surface. Either of these tests will conclusively prove whether a hose is porous.

Recently a prominent air-brake man, who, by dint of perseverance, intelligent direction and material support of higher officials, had sought and achieved a remarkable betterment in air-brake maintenance on his road, found that many hidden train line leaks were eluding his careful inspectors and causing his air pumps to run hot in keeping up leaks on long trains. He finally suspected porous hose, and, in addition to the usual form of inspection tests, applied the soap-suds test, during which it transpired that 6 per cent. of the freight hose tested was found porous, and was therefore removed. Thirty per cent. of this amount had abrasions in the inner lining of the hose where the nipple had been inserted. Eleven per cent. of the passenger hose treated was likewise removed and replaced—and this after the train had passed the ordinary test which failed to bring out hose porosity. Air-brake hose of certain manufacture which replaced the porous hose was found to be as porous as the old hose, and was consequently condemned. When the porous hose was removed and replaced with good, the engineers, without solicitation or any knowledge of the porosity test, went to the inspector and voluntarily told of the ease with which the train pipe pressure was now kept up, and the consequent remarkable freedom from hot air pumps. No stronger proof of the potency of this test is needed.

Coincident with the above discovery, another air-brake man, several hundred miles distant, was splicing old air-brake hose and testing it. He used new hose, which he cut off in lengths to suit the old parts spliced. In testing for porosity he found that the new portion of the spliced hose oftener leaked than the old part which had seen much service, nearly 40 per cent. of the repair hose being, for this reason, unavailable and unfit for service. Investigation showed the old hose to be of a high-grade manufacture, while the new portion was much cheaper, said to be "just as good," and thought to be "plenty good enough" for repairs.

It is not our intention nor desire to discuss here the relative merits of high-grade and cheap air-brake hose, but rather to present briefly to railroads for consideration and correction a serious shortcoming, practically demonstrated, which menaces the safety of train movement. No chain is stronger than the weakest link. No matter how efficient air-brake maintenance on one's road is held to be by its officials, the loose system of inspection which permits the serious leakage due to hose porosity to pass unheeded is verily of the bung-hole kind, and therefore of comparatively little real value. Especially is this true and of growing importance in the present stage of railroading, where fifty and even seventy-five air-braked-car trains are common.

Must the Link Motion Go?

The shifting, or so-called Stephenson link motion is almost exclusively used on American locomotives, and in the past it has given better results than any of the other types which have been experimented with. But there is some reason for believing that the shifting link motion has outlived its usefulness. It was all that could be desired for light engines, but with the tremendously heavy locomotives coming into use, the connections of the link motion have to be made so heavy that destructive stresses begin to deteriorate the motion as soon as it goes into service, with the result that breakage and failure on the road are becoming painfully frequent. Any kind of a motion that will remedy these defects in a small measure will be welcome to railroad men, and we are greatly mistaken if experiments towards a change will not soon be undertaken by leading railroad companies.

To actuate the immense valves that are now regarded as essential for heavy locomotives, the eccentrics must be made so large both in bearing surface and in weight that it wears the other connections very rapidly, induces lost motion on its own bearing surface and calls for extreme care to prevent the friction of dry surfaces, that nearly always results in breakage; and the breakage of an eccentric strap is one of the worst kinds of accidents that can happen to a locomotive; for even should it not smash a hole in the firebox, it generally distorts connections in such a fashion that nothing short of rebuilding gets the valve motion back into its normal condition. The writer once had a very convincing lesson of the very serious results due to the breaking of an eccentric strap and the twisting up of the motion that ensued. The road was extremely short of power, and when this engine arrived at the turntable, about noon, we supposed there would be no difficulty in getting her out with a train at 6 A. M. next morning. All of what we considered the distorted parts were quickly taken down. Some were sent to the machine shop to be adjusted, and others to the blacksmith shop. By the time a new eccentric strap was bored and fitted, which was no lightning job, the other parts were ready to be put up. They did not go together as smoothly as the parts of an air brake. In fact, there arose mysterious needs for fitting, and it was well towards morning before the valve motion was put together. Then the toilworn "we" went home, after telling the night foreman to run over the valves. When we returned at 7 in the morning the engine was where we left her, and the night foreman was almost hysterical, while declaring that it was impossible to set the valve on the side of the broken eccentric strap. They had set it after a fashion and tried to take the engine out, but she hung so much "in the britchen," as they explained it, that the engineer refused to take her out. After considerable labor spent on setting the valve, we got it set so that a good-natured engineer ventured to take out the engine; but the exhaust never approached being square until the engine received a thorough overhauling.

We have related this incident to indicate how troublesome and far-reaching the breaking of an eccentric strap may be. The valve motion needed for the heavy modern locomotive is one which dispenses with eccentric straps. There are a variety of radial valve gears which meet this condition, and we should like to see some of them given a fair trial. Joy's motion and the Walschaert motion have both been tried on several of our railroads, without giving results that recommended them as a substitute for the link motion. That was in the days when it was rare to find a locomotive heavier than 50 tons. The changed conditions to-day may make any of the radial motions superior to the link. The principal objection advanced against radial motions has been the number of pins that must be employed for the numerous joints. As the inevitable wear grows in magnitude, a time comes when the movement of the valve is very irregular. Another objection which our people urge against radial valve gears is, that the lead opening is constant. We believe that a constant lead could be manipulated more easily to provide a satisfactory distribution of steam than the link motion with a very short eccentric rod, which is becoming the normal condition with very large engines. The renewing of pins when they become worn would not be so troublesome or call for so much work as the repairs rendered necessary when an eccentric strap breaks. At all events, we think it is high time that railroad men were casting their wits about to see if a valve motion less susceptible to accident than the link motion cannot be procured.

Technical Education for Enginemen.

There is considerable quiet thinking about this subject done among all classes of men in the locomotive department, although very few of them speak their mind freely about it.

All of them recognize the fact that there is a demand for an education that is far greater in the technical line than ever before. The young and ambitious ones seem in some cases to welcome this, as it gives them a chance to learn the principles and theories before they get a chance to learn the operations by actual experience. The older ones who have grown up with the methods of learning by seeing someone else do it, or, as we can better express the sentiment, by being shown how, are in despair at the new requirements.

Now, what is a technical education as distinguished from a purely operative one? Playfair in his "Subjects of Social Welfare" says that "Technical education means that those who are engaged in an industry should have a trained intelligence and understanding of the special industries which they enter as bread winners."

A technical education can also be defined as the knowledge of the theories and principle on which mechanical operations are conducted. Neither of these definitions call for what is termed a college education or demand that an engineman should be educated to a high degree, in the purely scientific part of railroad work—that properly belongs to the mechanical engineer or designer.

Locomotive Engineering does not take the stand that an education of a very high technical nature is necessary for an engineman to-day, but it can see the signs of the times plainly, showing in all the movements towards an increased knowledge of all mechanical appliances used on railroads. We think that this matter can be pushed too fast, so that the majority of enginemen now in service cannot very well keep up.

There was a time when a railroad engineer could get along fairly well with a limited education, but to-day it is different, and no amount of protest will stop either the demand for a higher education or the desire to meet that demand. The scope of a man's education has been enlarged partly by competition from the younger men, and more by the fact that the amount of machinery now under the charge of an engineman has rapidly increased in a few years past. If the number of separate devices which now constitute the complete locomotive keep on increasing, it will not be long before the locomotive will merit the name now given them of "battleships," for the man in charge of one of them will require as much knowledge, both technical and practical, as the chief engineer on a war steamer.

If this is the condition, how can we best meet it? is the question that comes up in every engineman's mind. It is no use to think that protests will avail to check the movement towards a thorough mechanical education for engineers; that has been done for some years back with no effect. The best way is to meet the question fairly and squarely without trying to dodge it or belittle its importance.

A technical education is not as hard for a man to master if he has good practical ideas and is working among the machinery each day, as he is liable to think it is before he tries it. If the strictly theoretical man can learn about the operations, the practical man can learn them easier, and the theoretical man must practice the operations to make his knowledge of any profit to him.

All knowledge is only gained as the result of some mental exertion. If not from text-books, it must be from seeing the operations performed. Much of the work done by men well along in years in their endeavor to learn from text-books is misplaced. They do not take time to commence with the rudiments and thus be sure of every step, but start in at the last chapter and then work back towards the primary lessons for explanations. This starts them in at the hardest part of it, and they very naturally lay it aside for some future time when they feel more like it.

A well-informed man is not always the man who learns a little of each of a great many things, but one who knows a good deal about the matters which directly concern his own trade or profession. To be well informed, you must go to the bottom of a subject and learn how each effect comes from some cause.

We often hear men say, that they can work any device on a locomotive if it is in good order. Very true, and so can a beginner, but what the railroad work calls for is an intimate knowledge of the construction and operation of a device, so you can work it even if it is not in perfect order. We do not find locomotives in perfect order at all times. A skillful engineer must be able to locate the trouble when a machine will not work if he is to be a successful one.

The trouble with most of us is that we have not so far seen any need of anything better than the old method of doing "as well as the average." Now, if we are sure the average never will change, we can take things easy; but the general average of knowledge and information is rising every year, so that if we all keep up with the average, we have got to raise our standard every year or work towards the lower grade.

Some men insist that they cannot remember anything they read in a text-book. It is easy to sneer at book-learning and think what a man tells you and shows you is all right. What is told you orally must be retained by the memory, but that which the same man tells you on the printed page is where you can refer to it at any time. It can be told as often as you care to read it.

If you pick out a poor book to learn from, it is your own fault, just the same as when you pick out any other bad company.

Get the best—there is nothing too good for the progressive engineer in this age. He is entitled to it and he appreciates it.

BOOK NOTICE.

"Free-Hand Perspective." By Victor T. Wilson. Published by John Wiley & Sons, New York. Price $2.50.

Perspective drawing is something that very few mechanics know much about, yet it often tells the story of a machine or appliance better than a number of the usual elevations; not that it is likely to supplant the regulation method of drawing for machine work, but as an addition to it there seems to be a field for it. If an outline in perspective of a machine, or a part of it, were given, there would be less difficulty in understanding the location of various parts. The author does not, however, urge its use, but rather points out as plainly as possible the best method of acquiring the art of sketching in perspective. With the aid of numerous diagrams he illustrates his methods and gives some very good examples of this kind of work. We believe it is a good thing for every draftsman to know, and the book should be of value to anyone interested in the subject.

Wrecking of Weak Cars.

The wreck illustrated in the annexed engraving shows a line of weakness in car construction which has become very conspicuous since the advent of 40-ton cars and 80-ton locomotives.

Mr. George Westinghouse, who has devoted a great deal of attention to draft gear of cars, has recently contributed to the *Railroad Gazette* a letter on draft gear, which deserves the attention of all railroad men responsible for the safe movement of trains. Mr. Westinghouse says: "It is apparent that the introduction of heavy steel cars and very heavy locomotives has given to the railroad managers of the country a problem of great urgency, but with a set of conditions so fortunate as to render a solution thereof less difficult than it would at first appear.

ANCIENT CAR THE POINT OF LEAST RESISTANCE.

By their united action a form of car coupler and draft gear adequate to meet all possible contingencies can, and should, be selected and decided upon as a standard for all new cars, and which will also be suitable to replace the hundreds of imperfect and weak kinds now in service.

The experience in the daily use of the many heavy locomotives and thousands of steel cars capable of carrying loads of 50 tons each, has shown remarkable economical advantages; and it may thus be expected that notwithstanding the great damage inflicted upon the draft gear and end sills of light wooden cars by reason of the incidental strains and heavier blows, there will be, as indicated by recent contracts, a rapid extension of such heavy equipment.

The difficulties already experienced in the operation of mixed trains have demonstrated that there must be a radical strengthening of the existing draft gear, in order to avoid costly accidents, as well as to insure a reasonable life to the million and more wooden cars in the country, the constant use of which is necessary to meet the demands of an increasing traffic. As an illustration, it may be said that of the cars out of service and awaiting repairs, fully 70 per cent. is due to defective draft gear.

As the result of many years' work and of practical experience in the development of friction draft gear, I have come to the definite conclusion that there can now be selected a standard coupler and draft apparatus capable of eliminating nine-tenths of the present losses due to the employment of the present inadequate kinds.

The interests of the manufacturers of couplers might seem to be a chief difficulty to be overcome in the selection of a standard coupler and draft gear; but in these days of agreement between conflicting interests, it should not be troublesome to bring about an exchange of licenses under controlling patents, upon such terms as would insure to each party a proportionate share of the larger business which would inevitably result from the general use of a stronger and heavier type of coupler.

The managers of our great railroads, who have already achieved so much in other directions for the mutual benefit of the properties in their charge, should be able, if they make the effort, to solve this important problem, and in so doing, would insure further economies of vast importance, and at the same time add greatly to the safe working of all of their trains. Will they do so?"

The Flow of Metal Exemplified by a Rivet.

BY GEORGE S. HODGINS.

There are some people who appear to think that the expression, "As right as a trivet," is equivalent to, or in some way interchangeable with, the simile, "As tight as a rivet." As a matter of fact, there is no connection between the phrases. A trivet being a three-legged stand, and readily accommodating itself to any inequality of the ground upon which it may rest, very easily becomes "right," under differing circumstances. Not so a rivet. It can only be tight—that is, permanently tight—when certain definite conditions have been complied with. It owes its ability to be tight at all to the ductility of the metal of which it is composed, and this ductility is in a general way the property by reason of which the metal can flow.

We are accustomed to apply the word *flow* generally to a liquid or a gas, but examples of the flow of solid matter are not wanting. Ice is the solid form of water, yet in glaciers the phenomenon of flow is distinctly seen. Glacial ice will turn a corner, or flow past a sharp edge of rock, or a boulder, which it cannot move, in a manner which suggests the action of a viscous fluid, like molasses or glue, or even shoemakers' wax, all of which require time to flow. The ice does not melt and so pass the obstruction, and then permit the water to freeze again. It flows very slowly and silently past the boulder while retaining its apparently solid form.

A few years ago, when the British Association for the Advancement of Science held one of its annual meetings in the city of Toronto, Canada, Prof. Roberts-Austen, the metallurgical chemist of the Royal Mint, London, delivered a popular lecture on the metals of Canada. Aided by a stereopticon, the lecturer showed two or three largely magnified instantaneous photographs of the splash made by dropping a marble into a bowl of milk. The form of the splash is very interesting. The first view showed the marble magnified to the size of a cannon-ball, just as it reached the surface of the milk. The second showed the disturbance of the milk's surface as the marble disappeared from view. The little globe, falling vertically down, had thrown the milk out from under its rounded surface, and had flung it up in the form of an irregular crown, perhaps more closely resembling an earl's coronet, which has a number of pearls on the ends of the golden stems which rise from the fillet worn by a nobleman of that rank.

The milk threw up a thin film completely around the marble, from which minute drops were given off at intervals all the way round. This the lecturer called the *coronal* stage of the splash, the subsequent one being where the film and drops and particles in the depressed area had rushed together from all sides and had met in the center in one small but pillar-like mass, which momentarily maintained an erect position. This was spoken of as the *columnar* stage, the last one being the sinking down of the little column and the formation of the familiar ripples, radiating from the center of the disturbance.

The point of interest for us, however, is the fact that the coronal stage of the splash showed the milk as having been thrown upward and in a direction *opposite* to that pursued by the marble as it fell down and was engulfed.

Similar stages were shown where a small globe of solid gold was dropped into a molten mass of the same metal, the difference being simply that the melted gold was far heavier than the milk, much more difficult to move, and more nearly approaching the condition of a highly viscous fluid. The splash was nevertheless essentially the same, and the heated metal threw up its tiny coronet of gold in a direction opposite to that of the falling particle.

Lastly, the stereopticon showed a photograph of a piece of armor-plate which had been pierced by a solid shot of the ordinary cylindro-conical form. Here the effect of the shot showed that the effort of the cold solid metal of the plate had been to flow. A hole had been pierced, it is true, which remained as a permanent formation, but the upper surface of the plate where the force of the impact has been first experienced clearly presented a rough analogy of the freely flowing milk or the more viscous gold. The edge of the hole had a raised circumference with a serrated margin rising from it and approximating to the coronal stages of the former splashes. The solid armor-plate endeavored to splash, and had thrown up a broken irregular edge in a direction opposite to that taken by the shot. It had tried to flow and had in some measure succeeded, though the hole had not closed up again, and the serrated edges of the splash had remained fixed.

Having now evidence before us of the flow of solid metal, even when cold, let us observe the behavior of a heated rivet, when being "driven." A glowing rivet is entered and pushed home by the sledge-hammer of the "holder on." The first few strokes delivered by the pair of riveters give out a dull sound as the rivet dances back and forward beneath the blows and the rebound of the holding-on sledge. Later, the cheese-head firmly grips the under-plate as the upper end flattens down and the hammers ring out true. Next the riveters beat out the point into something resembling a head, with the peens of their hammers and one of them applying a "button set" and the other striking with a flogging hammer produce the smooth, close, tight head of a "snapped" rivet.

When the hammers first struck the rivet, it packed down and began to fill the hole. It is at this stage that good fitting and close plates tell; for if they have been left at all apart, it is likely that the rivet metal would flow out between them and form a minute collar between the plates, which the subsequent "snapping" would be powerless to entirely remove. As the rivet filled the hole, the friction on its sides together with the help of the holding-on sledge keeps it firm while the rough head is formed, the metal flowing out on all sides, under the repeated blows, mushroom-like, makes a kind of head. It is, however, when the "button-set" is applied that the ability of the metal to flow comes most to the aid of the workmen. This instrument is struck downward, and the little hemispherical hollow is driven over the rudely-formed head. The metal flows downward to get out under the edges of the "set," and as it does so, the metal rises up in the center to take its place, until the cup-like cavity of the "set" is filled. This

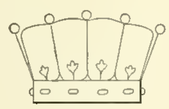


Fig. 1.

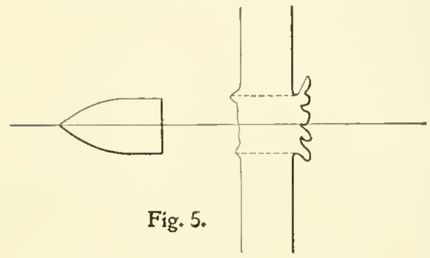


Fig. 5.

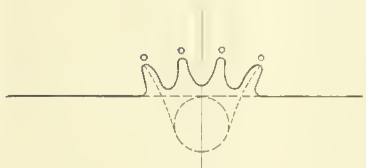


Fig. 2.

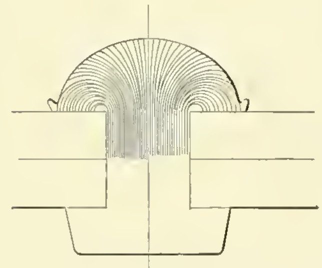


Fig. 6.

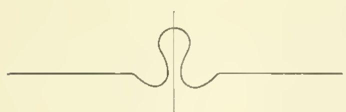


Fig. 3.

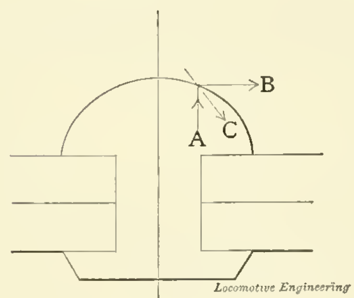


Fig. 7.

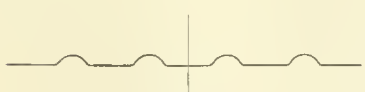


Fig. 4.

HODGINS' ARTICLE ON RIVETS.

rising up in the center is due to the fact that when the button-set is struck downward it presses first upon the circumference of the roughly-made head, and upon a circle larger than that of the stem of the rivet. The upper plate is also pressed down by the force of the blow, and the inertia of the under plate and the sledge below causes the plates to come closer together, and so forces more of the rivet stem up into that portion which will be the finished head later on.

When the cavity of the "set" is fully filled, the phenomenon of "flow" may be more clearly seen. An illustration of what has taken place may be had if a good tight rivet with portions of the plates it holds be sawed or planed in two and polished and then etched. The fibers will show that there has been a distinct flow of metal down the outer edge as well as internally. There is no doubt that some particles of metal which were once at the extreme upper part of the rivet shank have moved downward and outward, either along the surface in contact with the set or have taken up some intermediate position between edge and center. When it happens that a portion escapes under the set, it will show all the characteristics of a certain kind of "splash," by its slightly broken circumference. The flow of metal in a snap-headed rivet is, in a manner, like that of a fountain of water. Metal rises slightly in the center and metal is turned over, umbrella-like, and moves downward through a minute distance. If one was to take a locomotive reflector, and, closing the openings for burner and chimney, hold it squarely over a vertical jet of water, one would find that the down flowing water poured out from the circumference of the reflector. If the reflector was lowered quickly, no difference would be detected, except that greater quantity of flow would result.

The rivet in position, with rough-head formed, is held there by the underside of its head, the friction on the packed-up stem and the holding-on sledge. When struck down smartly by the "set," it offers a certain amount of resistance, so that, if one may say it, it has not time to move down as a whole, before the upper portion seeks to get out of the way by the easier method of flowing out under the "snap." As the pressure of the button-set is downward at every point, and not radially toward the center of its cup-like hollow, it follows that a resolution of forces will show that only at the very top of the "set" the force there acts vertically, the resultants of all the others tend to drive the particles of hot iron off from the center and downward. In considering this, it must be remembered that "action and reaction are equal and opposite" and that the downward pressure from the set produces an equal and upward pressure in the rivet. This fact makes the resolution of forces somewhat more easily followed. In Fig. 7 the upward pressure, if represented by the arrow line *A* and the outward motion by *B*, then the resultant will be the line *C*, which at its origin coincides with the curved surface of the set. The pressure on the center line is not so resolvable.

If a drop of water be placed upon a piece of porous wood and struck squarely by a hammer before it has time to sink into the wood, it will be found that the water did not under the blow take time to enter the wood, mobile as are the particles of water, but shot out in all directions from the center, the lines of flow varying in length, but each strictly a radius in direction.

When a counter-sunk rivet long enough to be eventually cut off is driven, the outer edges will break in radial lines, as did the water. The flat-headed rivet will really have made a slow splash, and to finish the work neatly the extra thickness of head with serrated edges will have to be cut off.

The presence of the button-set on the rivet first considered, acted downward, but only upon a small area was this pressure vertical. It acted over a larger area, driving downward and outward, or always at some angle to the direction of the hammer blow. The underside of the head as it lies upon the sheet cannot go down. It cannot move inward, and the particles above can only endeavor to splash outward from under the set. This action helps to draw the sheets together, and presents the curious appearance of a rivet struck downward, rising upward under the blow. It is upon the ability of the metal to flow that the utility of the rivet depends, and the hotter it is, or the more it approaches perfect viscosity, the easier and better will be its flow.

The top of the steel button-set, cold, hard and refractory as it is, yet shows in the brooming over of its upper surface under the blows of the hammer, its slower and somewhat more crude attempt to flow and splash, as did the milk, the gold, the armor-plate, and the rivet. Treat a piece of stone in a similar way, and no flow and no splash appears, even in the most rudimentary form. Without ductility in some degree, or the tendency to flow under pressure, it fractures at once.

An Idea in Steam Gages.

The position of the hand on the dial of a locomotive steam gage has considerable to do with the use the fireman makes of it. It is rarely that old gages show the figures so plainly that they can be located in the dim and uncertain light of a cab lamp in the night.

After a fireman or engineer once learns about the relative position of the pointer when the boiler has the full pressure of steam allowed, he does not bother much about the figures, but figures on the location of the pointer.

Gages do not always show the same figures in the same relative position on the dial. One gage will have 100 at the top of the dial, another one may show 120 and others show still higher pressure at the top of the circle.

Engines do not all carry the same pressure; so that on one engine the pointer may be perpendicular; on the next one it may be horizontal when the steam pressure is proper.

A superintendent of motive power on a trunk line in the West proposes to amend this condition and have all the gage hands stand perpendicular when the full pressure allowed is carried with the pointer at the top of the dial. Of course with this method the gages will be kept on certain classes of engines as much as possible, and not changed indiscriminately around on all engines.

For instance, the class of engines carrying 200 pounds of steam will have the dial so placed that the figures 200 will be at top. The class of engines carrying 180 pounds will have the dials placed on the gage so that 180 will be on the top. This will in no way interfere with the internal mechanism of the gage; as, after the dial is placed so the proper figures are at the top, the gage hand can be put on the post so as to register correctly—that is, set it at zero to start with.

The Semaphore gage, so widely used in air-brake work, uses this same method—that of location as to the perpendicular and horizontal position for certain standard pressures.

At recent Sunday evening services of the Euclid Avenue Methodist Episcopal Church, Oak Park, Chicago, Robert Quayle, superintendent of machinery and motive power of the Chicago & Northwestern Railroad, spoke on "Purpose." "It is fundamental to success that people be actuated by a high purpose and work toward the realization of their ideal," he said. "This is especially desirable for young men employed in large concerns and where competition is at its height. The clerk should make it his purpose to reach people, and, by coming in contact with them, mark the contrast in social conditions."

The modern locomotive of huge dimensions does not as a rule ride easy. In fact, it bumps along in a manner that inflicts painful backaches upon the men in the cab who have to endure the jolting. We notice that a cheap remedy for this discomfort is offered by Haggard & Margusson, South Canal street, Chicago, in the form of a spring seat for enginemen which costs only two dollars. Men working on the pool system can enjoy the comforts of this spring seat for they can carry it from engine to engine as easily as they can an oil can. Send for a descriptive catalogue.

The Goodwin Car Company, New York, have issued a new catalogue showing their cars in operation.

Fast Run on Southern Railway.

A subscriber in Louisville, Ky., sends us the following cutting from the *Courier Journal:*

"The Southern Railway broke all records Wednesday morning by making the run from Louisville to Lexington—80 miles—in 86 minutes, with several slowdowns, which would actually make the entire running time about 80 miles in 80 minutes. This is the best long-distance record ever made in Kentucky or south of the Ohio river. The train consisted of one baggage combination car and Engine 999. The train was used in carrying papers with election news to Lexington and points south. In several places the speed reached 65 miles per hour, which is equal to the famous Empire State Express, it having the same number of engine. Great credit is given the train crew for making this time. Those of the crew were Engineer H. Muir, Conductor J. R. Bryan and Fireman A. C. Ransdell."

Telpherage.

Telpherage is a new word to many and was invented by Professor Fleeming Jenkin, who defines it as the "Transmission of vehicles by electricity to a distance independently of control from the vehicle." The old way was to send a wagon or truck with one or two men from the works at irregular intervals for the castings, patterns or other material to be moved. Now as soon as the castings or other material are ready, they are placed upon the telpher car, the circuit is completed and the car with its load starts towards the factory, slowly at first and then increases in speed until it approaches a curve where it automatically slows down. After passing the curve, speed is again increased until the end of the line is neared, when it automatically reduces speed and comes to a gradual stop. The works end of the line is so arranged that the stop may be made either directly over the scales or at the storeroom door. To start the car on its return to the foundry with new patterns, etc., requires but the work of an instant.

This system is controlled by the Consolidated Telpherage Company, Broad street, New York. It is adapted for the moving of all kinds of material within its capacity as to weight and bulk.

Counterbalance in Driving Wheels.

The St. Louis & San Francisco Railroad are now making a test of the Davis method of counterbalancing the driving wheels of locomotives, having placed new wheel centers under engine "228."

With this method there are two sets of counterbalance weights, 120 degrees apart and the same distance from the crank pin. The shape of these weights is preferably circular, where the wheel center is large enough, with the center of the weight halfway between the center of the axle and the tread of the tire. The Master Mechanics' rule for calculating the weight of the balance weights is used; but instead of putting the proper amount of weight with its center of gravity exactly opposite the crank pin or 180 degrees from the pin, double this amount is used, so that each of the balance weights has the same weight that the Master Mechanics' rule puts in one.

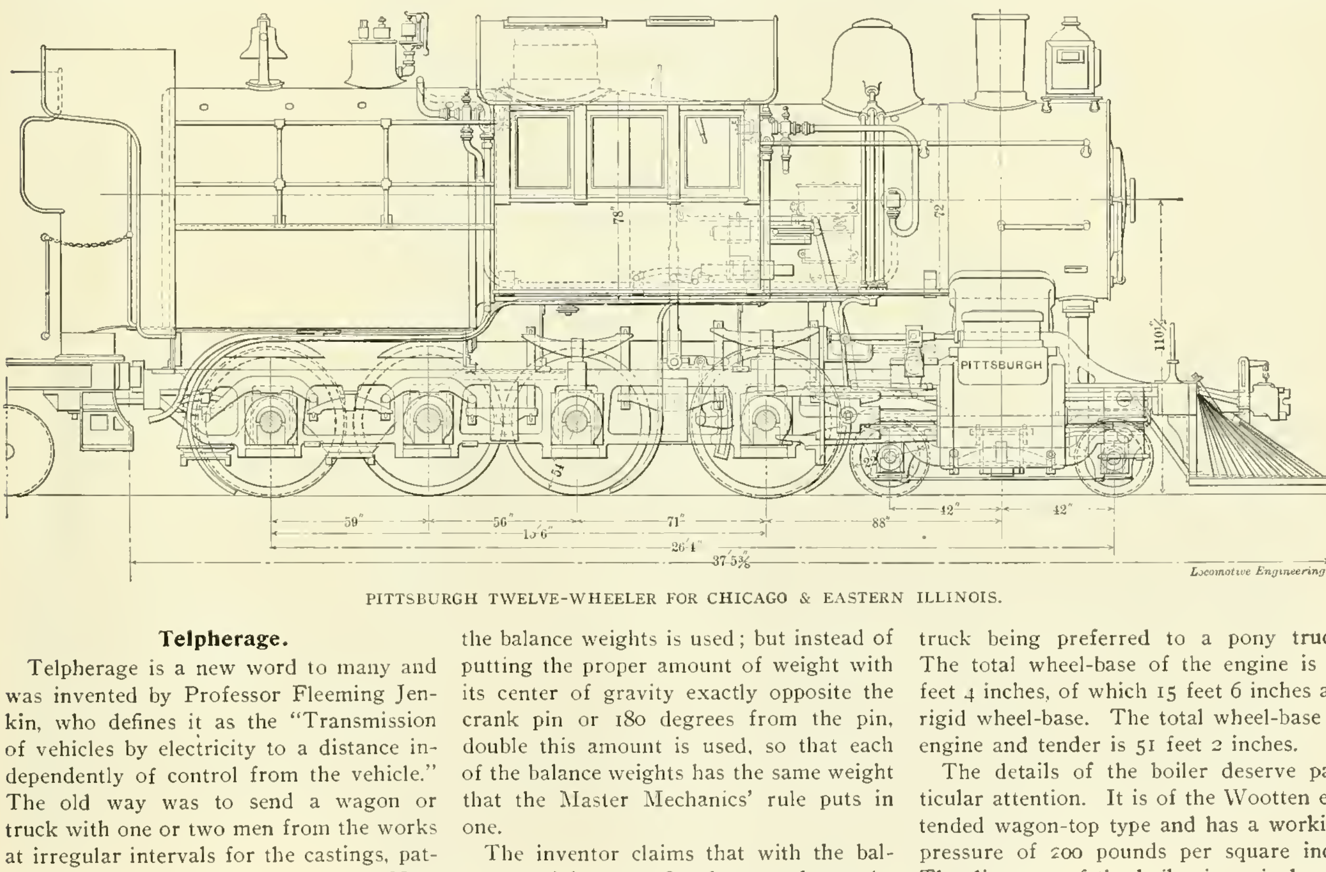
The inventor claims that with the balance weight set 180 degrees from the crank pin, when the crank pin and balance weight are on a horizontal line with the center of axle, a very severe hammer blow is struck on the rail; and that with three equal weights, 120 degrees apart, there is no serious blow. He also claims that by this method when a wheel is balanced for one speed, it is balanced for all speeds, whether fast or slow.

This device was however, thoroughly investigated by the Franklin Institute, of Philadelphia, and the claims were proved to be unfounded. It is not a particle better than the ordinary counterbalance.

Chicago & Eastern Illinois Twelve-Wheeler.

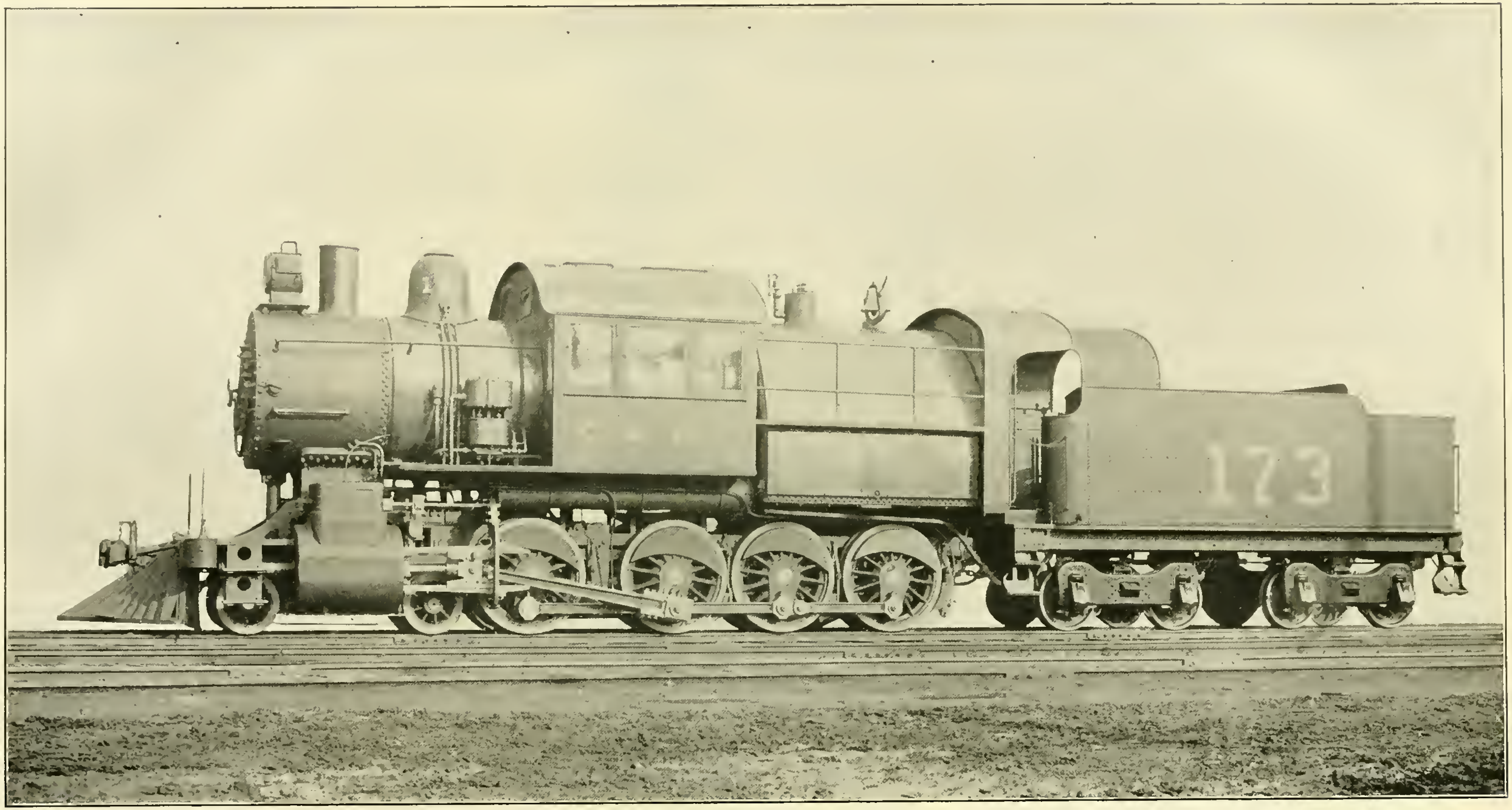
The Pittsburgh Locomotive Works appear to be taking a leading part in the building of locomotives whose great weight comes nearly up to the capacity of a 4-foot 8½-inch gage. One of the latest of their products is shown in the accompanying engravings, on pages 527 and 528.

This is a tremendously heavy twelve-wheel compound locomotive, weighing in working order 189,700 pounds. This is not so much weight as some of the locomotives of the consolidation type turned out by the Pittsburgh Locomotive Works have been, but we presume that the road-bed and track of the Chicago & Eastern Illinois have influenced the weight to be carried on the driving wheels. The engine truck carries 39,700 pounds. The additional weight that the cylinders of a compound locomotive put upon the front end probably accounts for a four-wheel truck being preferred to a pony truck. The total wheel-base of the engine is 26 feet 4 inches, of which 15 feet 6 inches are rigid wheel-base. The total wheel-base of engine and tender is 51 feet 2 inches.



PITTSBURGH TWELVE-WHEELER FOR CHICAGO & EASTERN ILLINOIS.

The details of the boiler deserve particular attention. It is of the Wootten extended wagon-top type and has a working pressure of 200 pounds per square inch. The diameter of the boiler is 72 inches at the front ring. The horizontal seams are sextuple riveted and the circumferential seams lapped and double riveted. The boiler provides 2,447 square feet of heating surface, of which 2,265.6 are in the tubes and 181.4 square feet in the firebox. The grate area is 72 square feet, which is enormous for an engine designed to burn bituminous slack coal. General railroad experience in the burning of bituminous coal in wide fireboxes would lead us to think that a considerable area of dead plate on these grates would conduce to the economical consumption of the fuel, but



CHICAGO & EASTERN ILLINOIS TWELVE-WHEELER.

the designer probably knows what surface is likely to give the best results.

The firebox is 9 feet long, 8 feet wide; the front depth is $71\frac{5}{8}$ inches and the back width $59\frac{5}{8}$ inches. The water space in front is 4 inches and in the back $3\frac{1}{2}$ inches, while the sides have 3 inches. There are 300 tubes of charcoal iron with a diameter of 2 inches, the length being 14 feet 6 inches.

The cylinders are $21\frac{1}{2}$ and 33 by 30 inches stroke. The journals of the driving axles are $8\frac{1}{2}$ x 10 inches, and of the truck, $5\frac{1}{2}$ x 10 inches. It will be seen from these dimensions that the bearing surfaces are very liberal.

The engine has balanced slide valves, with a maximum travel of 5 inches for the high-pressure side and 6 inches for the low-pressure side. The outside lap is 1 inch; the inside clearance $\frac{3}{8}$ inch, and the lead in full gear 1-16 inch.

The line drawing which we illustrate shows all other dimensions about the locomotive that railroad men are likely to be interested in.

Dunlap & Plum, of Columbus, Ohio, are the latest to go into the pneumatic tool business. Their introductory catalogue has just been received, and shows several drills at work under various conditions.

Air-Brake Department.

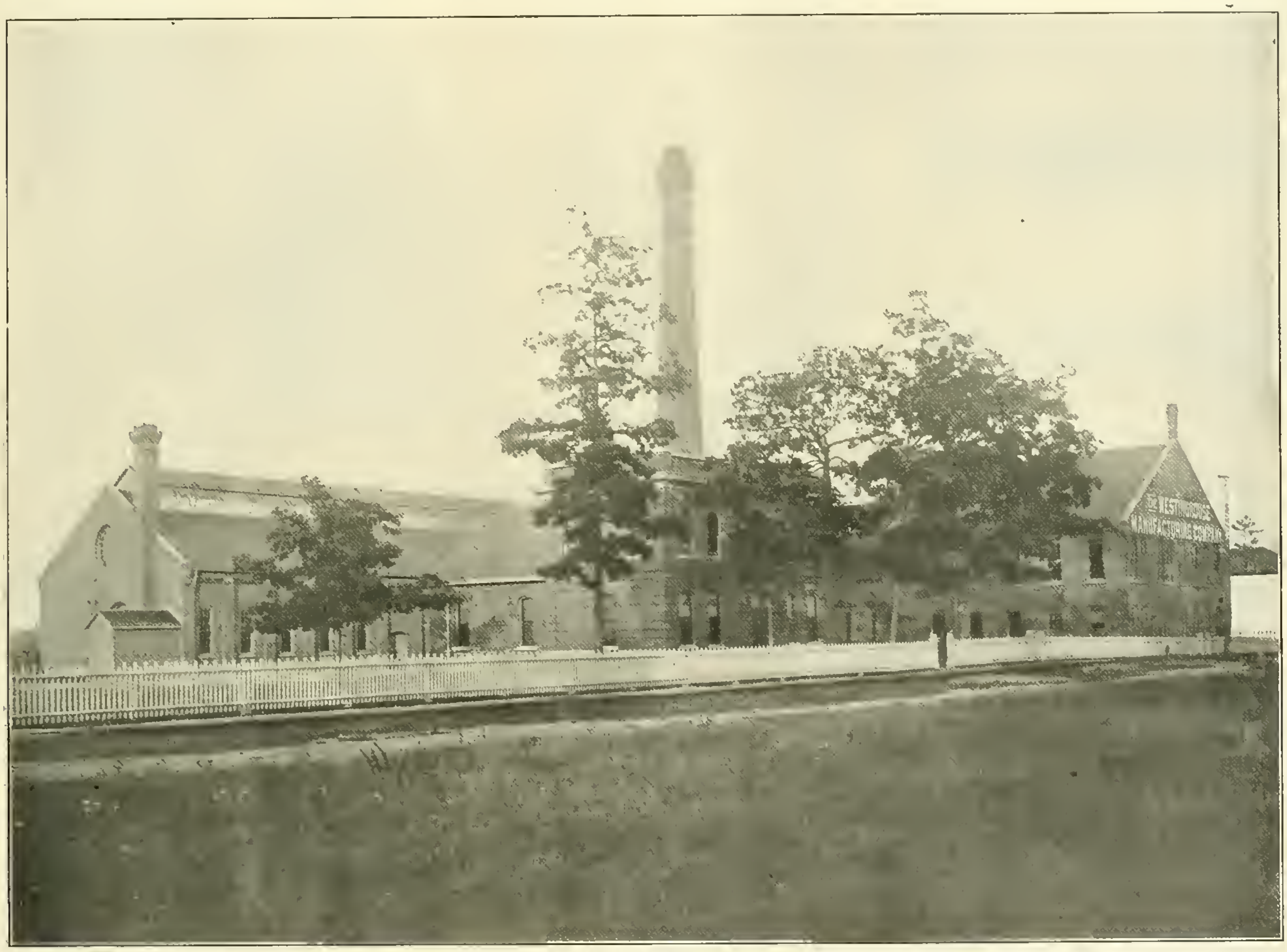
CONDUCTED BY F. M. NELLIS.

Triple Valve Repairs.

Although much has been written and said of late on the repairs of triple valves, a little more just now may not be superfluous. The principal repairs made on a triple valve taken from service is the fitting of a new packing ring in the piston and bushing. Nearly all other repairs can be made without detaching the triple valve from the car, until such time as the necessity for general repairs shall cause its removal. The renewal of the packing ring, however, is such an important event in triple valve repairs, that the valve must be taken down in order that the necessary delicate fitting may be most advantageously done.

Until recently, railroads have generally repaired their own triple valves with varying and doubtful degrees of success, claiming and believing, of course, that such work was as efficiently and economically performed as though the manufacturer himself had done it. Perhaps these claims and beliefs are warranted in some cases, and at least in some degree, but the experience gathered from close contact with the work and a study of the conditions existing in actual practice seem to argue contrariwise. The high-grade machinery and other special facilities possessed by the manufacturer make it possible for him to more accurately and economically perform the work than the railroad can do it with the comparatively limited means at hand. In the manufacturers' shops many thousand strokes of the piston in the bushing are made by a rapidly moving machine, to make air-tight surfaces between the ring and the bushing. The railroad attempts this either by hand or by a hand machine. The one method is as far ahead of the other as the sewing machine is ahead of the hand needle.

In the past general repairs to triple valves have usually been made by railroads only at idle moments or such intervals when rush work did not occupy the time of the repairman, and were more intended as a means to keep him going until emergency work should claim his attention, than an organized effort to keep triple valves in repair. Now, the triple valve itself is emergency repair work, and, as such, demands proper attention. Although long-suffering and least resentful of neglect and abuse, the triple valve has a limit, similar with a starved, worn-out horse, where it ceases to do its work. Then, but comparatively few triples were in use, and they were all new. Repairs were occasioned only by accidents and breakages. Now, there are thousands of triples in service, and many of them old and so worn as to necessitate repairs. Then, with but a few air brakes in each train, a triple valve did not resent, by sticking brakes and flat wheels, worn piston packing rings and poor repair work; and several instances are known where half the packing ring was gone, still the brake applied and released without giving trouble. Now, fifty, and even seventy-five air-braked cars operating in one train are not unusual, and packing rings must be in



WESTINGHOUSE AIR-BRAKE COMPANY'S WORKS, HAMILTON, ONT., CANADA.

absolutely prime condition, else they will manifest their grievances through delayed trains, sticking brakes and slid-flat wheels.

Conditions have changed. The practice of triple valve repairs of twenty years ago will not do now, and must give way to modern, adequate methods to meet the changed conditions. And the great volume of the work, lower cost and greater accuracy, and unusual inducements offered by a painstaking, trustworthy manufacturer will bring it about.

Device to Facilitate Brake Cylinder Cleaning.

A device which seems to have gained favorable consideration with several railroads is Chubb's air-brake repair tool, which we illustrate herewith. Its operation is as follows:

Screw the tripod on stem of tool one-third the distance of thread before using. Remove the push rod from piston sleeve, then insert tool in the tube with the wheel on top, as in Fig. 1. Give the tool a half-turn, bringing the wheel below the stem of tool, as shown in Fig. 2. Lift the wedge end of tool to top surface of tube, the wheel will travel forward automatically and become tight on the wedge of the stem. Screw the tripod against the cylinder head. The bolts and piston can then be removed with safety and ease, as shown in Fig. 3. After replacing piston and head bolts, unscrew tripod, tap end of stem slightly releasing the wheel, turn the tool, wheel on top, and it can be easily withdrawn.

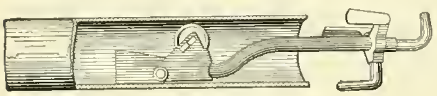


Fig. 1

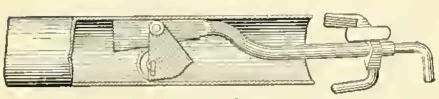


Fig. 2

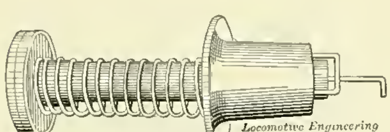


Fig. 3

CHUBB'S AIR-BRAKE TOOL.

Squirting oil into the brake cylinder *via* the oil-hole route is certainly bad enough; but the prize for stupidity should be passed to the repairman (?) who, the other day, attempted to oil the triple through the exhaust port.

CORRESPONDENCE.

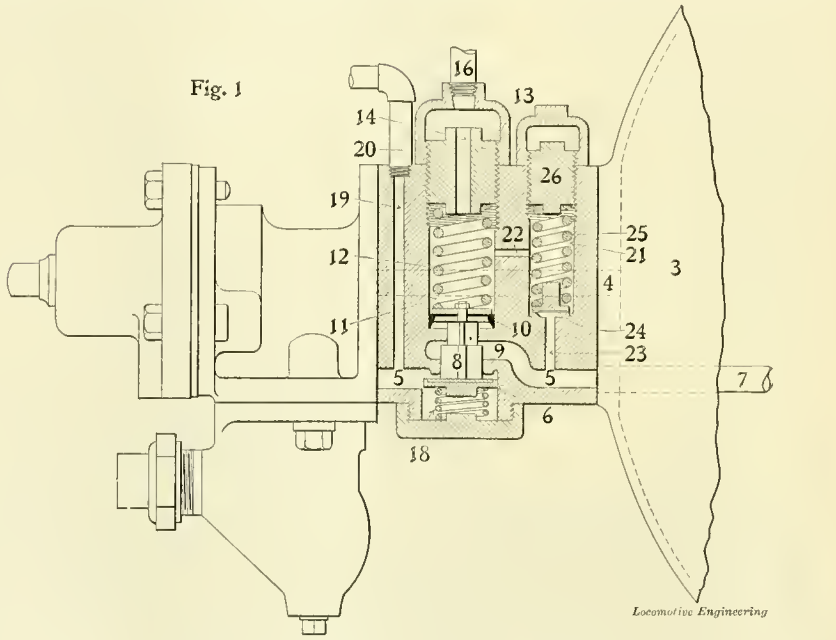
Automatic Adjusting Device for Loaded and Unloaded Cars.

Editor:

In the operation of a brake apparatus embodying my invention, the auxiliary reservoirs are charged through the ports 4, Fig. 1, and the triple-valve pistons moved to release position, in the ordinary manner. In this position, assuming the car to be light or unloaded, the piston 10 will be subjected to atmospheric pressure on opposite sides, and will be pressed down and held in its lowest position by the spring 12, which is of greater tension than the closing spring 18, and the regulating valve will be held unseated by the end contact of the wings 9 and 8, free communication being thereby established between the brake cylinder port of the triple valve and the brake cylinder through the port 5. Upon the movement of the triple-valve piston and slide valve to service or to emergency position, effected by a reduction of train-pipe pressure in the usual manner, air will pass from the auxiliary reservoir to the brake cylinder through the triple valve, the port 5 and pipe 7, and the brakes will be applied. Air will also pass into and fill the controlling valve casing 28, Fig. 2, through the port 19 and pipe 20, Fig. 1. As soon as the pressure in the brake cylinder reaches the limit considered to be proper for the light weight of the car, which is determined by previous adjustment of the tension of the spring 12, which bears on the piston 10, said piston will be raised by the brake-cylinder pressure acting on its lower side, and its bearing on the regulating valve 6, being thereby released, said valve will be closed by the spring 18, and the excess of air pressure on the lower side of the valve and further supply of air to the brake cylinder will be cut off. In the event of leakage of the regulating valve after its closure, when the auxiliary valve 24 is employed, excess of brake-cylinder pressure will be released by the unseating of the auxiliary valve, the excess air being thereupon discharged through the port 22, into the piston chamber 11, and thence through the pipe 16, valve cavity 34 and port 35 to the atmosphere.

During the periods in which the car is light or unloaded, the controlling valve 30 will be held in its lower position, as shown in Figs. 2 and 3, by gravity or by gravity and brake-cylinder pressure combined, as the case may be, thereby maintaining open communication between the piston chamber 11, Fig. 1, on the upper side of the piston 10 and the atmosphere, and providing for the closure of the regulating valve when the desired limit of brake-cylinder pressure has been reached, as above described. When, however, the car body is depressed by a load, the consequent lowering of the body bolster 29, Fig. 4, and the connected controlling valve casing 28 and regulating lever 37 brings the free end of said lever into contact with the lower bearing of the piston 33, which through the pressure of the spring 44 and stem 40, on the lever 37, raises the free end of said lever and consequently raises the piston 33 and connected controlling valve 30. Communication between the pipe 16 and atmospheric discharge port 33 is thereby cut off, and communication between the pipe 16 and the pipe 20 and ports 19 and 5 is established, through the valve cavity 34, the port 36 and the interior of the valve casing 28.

Under the conditions last above stated, when air is admitted from the auxiliary reservoir to the brake cylinder to effect an application of the brakes, it is coincidently admitted through the port 19, Fig. 1, and



M'CARTHY'S AUTOMATIC REGULATING DEVICE.

the then communicating pipes 16 and 20, Fig. 2, to the piston chamber 11, Fig. 1, on the upper side of the piston 10. Said piston being then and thereby subject to an equilibrium of brake-cylinder pressure on its opposite sides, is held in its lowest position in the piston chamber 11 by the spring 12, its wings 9 bearing on the wings 8 of the regulating valve 6 and maintaining said valve unseated, thereby permitting the maximum braking pressure deliverable by

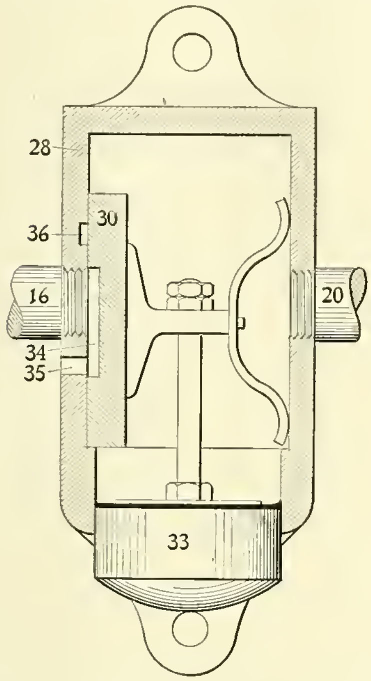
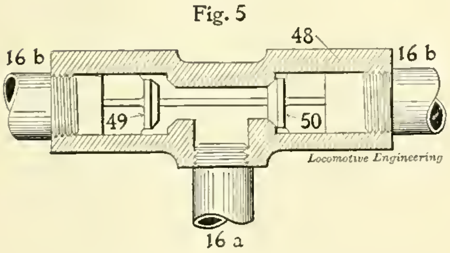


Fig. 2

Fig. 5


the triple valve to be admitted to and maintained in the brake cylinder in an application of the brakes. If the auxiliary valve 24 is employed, it is also subject under the above conditions to an equilibrium of brake-cylinder pressure on its opposite sides, and is held to its seat by its spring, 25.

Where, by reason of the liability of the car being loaded at one of its ends only, it is deemed desirable to employ a controlling valve chamber and its accessories at each end of the car, the operation, either when the car is unloaded or is loaded substantially equally throughout its length, is similar to that before described. When the car is loaded at either one of its ends and light at the other, the controlling valve at the loaded end will be raised by the adjacent regulating lever by the depression of the car body, and communication will be established between the brake cylinder port 5 and connected port 19 and the check valve 49 or 50, Fig. 5, as the case may be, at the adjacent end of the valve casing 48, through the connecting pipe 16*b*, the controlling valve casing with which it communicates and the pipe 20 connected thereto. The check valve 49 or 50 will thereupon be closed by the brake-cylinder pressure, and the controlling valve at the loaded end of the car will consequently fail to admit pressure to the piston chamber 11, so that the regulating

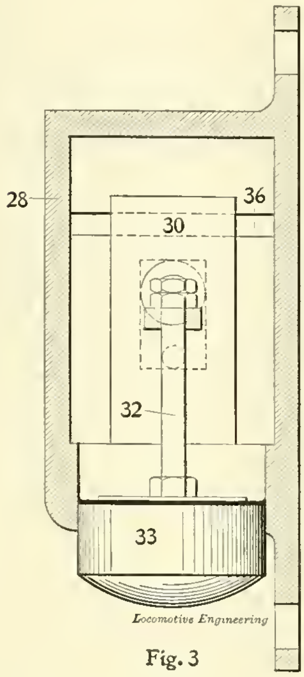
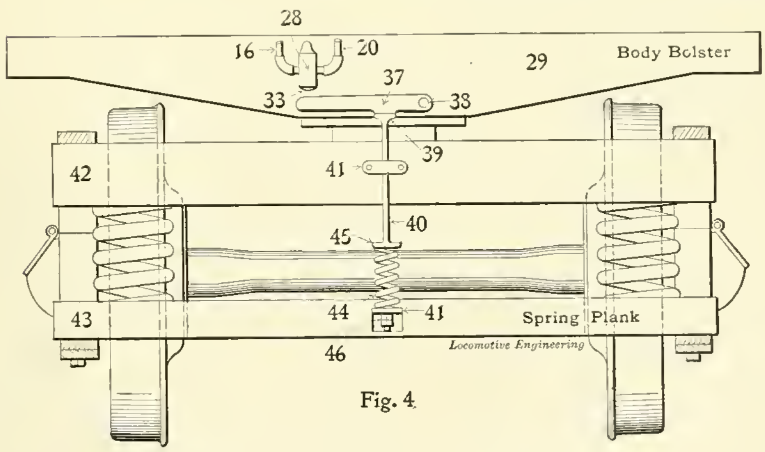


Fig. 3



M'CARTHY'S AUTOMATIC REGULATING DEVICE.

valve 6 will be closed and the admission of air to the brake-cylinder cut off, in the manner before described, when the limit of pressure determined for braking the unloaded car has been admitted to the brake cylinder.

Of course, it is understood that in applying this device, brake cylinders of sufficient capacity would be used to give at least 50 per cent. braking power on a loaded car, and so adjust the regulating valve that the proper amount would only be allowed on the empty car. This would be about twenty-two pounds for a 28,000-pound car. The relief or safety valve would be set to stand at least 10 to 15 per cent. higher pressure before opening. In constructing the valve casing I should arrange the two chambers side by side, one on the right and the other on the left of the feed port to the auxiliary reservoir. This would make the casting only two inches long and therefore would not require such long studs or cap screws to hold the triple valve and new attachment to the reservoir.

In practice, I should make the tap for pipe connection to the back of the valve casing that attaches to the car bolster into a boss on the casting and not have the large hole enter the valve seat, but have a 3-16 inch hole and a corresponding recess under the slide valve. This would allow the valve to be very narrow and of lesser area.

Brooklyn, N. Y. J. G. McCarthy.

Retarding Force of Brakes.

Editor:

We are told by those who are in a position to know, that the coefficient of friction between the brake shoe and wheel is less at high than at low speeds. Anyone who disbelieves the statement may have his doubts removed by reference to tables showing comparative distances in which air-braked trains have been stopped at various speeds.

There may be found the most convincing evidence that the maximum efficiency is gained when the velocity of the revolving wheels is lowest.

At first glance it seems reasonable to believe the opposite to be true, and no doubt the first impressions of the majority of those who have given the matter any thought incline to the latter belief.

Some writers have advanced the plausible theory that the increased retarding force of the brake when running slow was due to the greater tendency of the wheel and shoe to cling to each other after having become softened by the heat generated by the violent friction produced at high speed. While this theory is correct as far as it goes, it does not by any means solve the problem, and though not really misleading, is, by reason of its apparent sufficiency, likely to make one regard further investigation unnecessary.

To say that the coefficient of friction between the brake shoe and wheel is greater at 6 than at 60 miles an hour, does not mean that the friction between the shoe and wheel is least in the latter case, but that the efficiency of the combined action of both in retarding the movement of the train is least. If the shoe was forced against the wheel for the purpose of producing heat only, then it might be said that the coefficient of friction between the shoe and wheel would be greatest when the speed was highest.

If the brakes be applied while running fast, you can see the fire flying from the wheels, like sparks from an emery wheel when grinding. There is evidence of violent friction, and the retarding force of the brake at 100 miles an hour would be just as powerful as at 1 mile an hour, were it not for the fact that there is another power that is present when the wheels are turning at a high velocity, and at even 60 miles an hour it is such as to counteract the force of the brake in such measure that the brake may be suddenly fully applied without producing any appreciable jar in the train, while at 6 miles an hour it would cause quite a shock. It is the centrifugal force which is here the counteracting agent. It is present in all revolving or rotating bodies in a degree proportionate to the velocity of their revolution, and is that force which tends to cause all parts of a revolving body to fly from its center, frequently causing the bursting of flywheels, emery wheels, etc.

To those not familiar with the action of this force, a simple illustration of a wagon wheel passing over a muddy road may make it clearer. When moving slowly the mud is carried up and over the wheel, clinging to the tire throughout its revolution. In this case the centrifugal force is weak, and is overbalanced by the adhesive force of the mud, which causes it to cling to the wheel. When the wheel is made to turn faster, we see the mud fly from it, and it is the centrifugal force developed in the rapidly turning wheel which produces that effect. This same force is also present in the revolving car wheel.

The action of the brake shoe may be regarded as similar to that of the mud on the wagon wheel. The latter of course clings to the wheel by reason of its adhesive nature; the former because of a force exerted against it by the power in the brake cylinder through the medium of a system of connected levers. They both tend to oppose the centrifugal force exerted by the revolving wheels, and each is similarly acted upon by the latter force; so we see that the effect must be the same in both cases, and it is reasonable to suppose that the power which causes the mud to fly from the wagon wheel by counteracting its adhesive force, will, in the case of the braked car wheel, also counteract the adhesive force exerted between the brake shoe and the wheel, tending to throw the shoe from the wheel, and in that manner lessen the retarding action of the brake in a measure proportionate to the development of this opposing centrifugal force. THOS. P. WHELAN.

Bellevue, Ohio.

Neglected Brake Valves.

Editor:

The rapidity with which railroad companies are now equipping their engines and cars with automatic air brakes should be a signal to all persons who are responsible for the care and maintenance of this apparatus to be always on the alert to establish new and economical methods for repairing, never forgetting that unusual precaution must be taken in this direction. Otherwise, this indispensable safety appliance which has cost railroad companies thousands of dollars, is likely to drift into a neglected and very unhealthy condition. It should also be kept in mind that if there is any one place more than another where that motto, "Whatever is worth doing at all is worth doing well," should be applied, it is in connection with this work.

The importance of the above has been brought very forcibly to the attention of the proper persons on more than one occasion, especially within the last few months, when it has been observed that there seems to be a growing tendency among engineers and others to allow their engineers' brake valves to run without positive stops on the quadrant, thus robbing the equalizing discharge valve of one of its most commendable features. That the Westinghouse equalizing discharge valve is one of the nicest and most ingenious contrivances ever invented, cannot be denied; but, like all mechanical devices that are required to operate continually, its life is not without end. However, when manipulated properly, and in anything like good condition, it performs its duties in a manner that is beyond the reach of human hands to do likewise. In fact, the application of the brakes with this instrument is taken entirely out of the engineer's hands. For instance, when it is desired to make an application of the brakes, the brake valve handle is moved to service application position and allowed to remain there until the black hand on the air gage has dropped a sufficient amount. It is then returned to lap position. This movement, *either one way or the other,* need not necessarily be slow, as is the case with some brake valves that are manufactured, but, on the contrary, *can be moved as fast as the operator desires,* just so long as the service position is not passed while the movement is being made. This feature, which, as before mentioned, is a commendable one, precludes any possibility of train line air being discharged too quickly, or the flow cut off too abruptly, when engines are rolling while rounding sharp curves over bad track, etc. Of course, the above results are only had when positive stops on the quadrant of brake valves are maintained. When allowed to become worn, there is not only a tendency to make the positions unreliable, but also to incorporate in this normally model of perfection as an equalizing discharge valve, bad and undesirable features, similar to those embodied by reason of its construction in the old three-way cock.

In other words, if the brake valve is permitted to run in the above mentioned condition, and a service application of the brakes is wanted, the engineer will be required to move the handle *very slowly from lap* to *service* position, and in a like manner, when *returning* the *handle to lap* position. Otherwise, the handle is apt to be moved too far one way or the other. So careful must the engineer be at this time, that it is not an infrequent occurrence at night to see the engineer remove his glove or mitt when applying brakes, in order that he may feel with his finger just what position the handle is in. It seems unfair to impose this additional and unnecessary duty on the engineer, and it is the writer's opinion that the practice is not only inconvenient, but dangerous, and cannot be too strongly discouraged.

It is hoped that this will meet the eyes of interested parties, and that it will be a hint for them to make a canvass of their equalizing discharge valves, and if any are found in this condition, that immediate steps will be taken to put them in such shape, so they can be operated in the manner as intended by the manufacturers.

ALEX. B. BROWN.

Buffalo, N. Y.

Some Useful Compressed-Air Kinks.

Editor:

In your October number Mr. Malthaner furnishes a practical device for detaching the air-pump piston rod from the air-piston head. With this suggestion I wish to add a method for finding defects in pump on engines not under steam pressure, for with its use one may diagnose ailments.

In a roundhouse having compressed-air system, the air-brake man may convey air pressure to the steam end of the pump by means of a ½-inch hose and nipples screwed into the reversing valve cap. The hole in the cap in which the rod travels should be drilled ½ inch larger than the original size, thereby allowing the pressure to pass to the chamber between the main valve piston heads. The pump then in motion, one may readily locate the disorders sought.

If the air cylinder rings are to be examined, and the piston head is near the top of the cylinder, by opening the air-cock and immediately closing same the piston will travel to the bottom of the cylinder and remain there. In removing the top head, one often finds the piston at the bottom of the cylinder. By removing the plug in the bottom head of the air cylinder and inserting a fitting prepared for such purpose with an air hose attached to same, the piston may be forced to the upper position in the cylinder and the head easily removed. If work is to be done on the reversing plate bolts, leave the pressure on which forces the air piston head against center piece and prevents its turning.

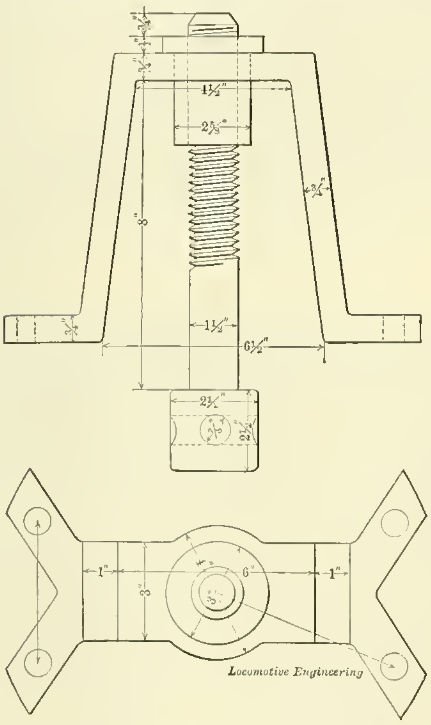
The same test method may be applied to the 6 or 8-inch Westinghouse pump. With the New York pump, remove draincock and insert the nipple there.

JOHN E. OSMER.

Piston Extractor for 9½-inch Pump.

Editor:

I submit herewith a drawing of a piston extractor in successful use at this point. The bracket for the piston extractor is



PISTON EXTRACTOR FOR 9½-INCH PUMP.

made from 3 x ¾-inch iron, and the hole for the nut is drifted out to near the finished size. This saves weakening the plate. The thread is 8 per inch, and buttress type. I also use the screw and nut out of the piston extractor to take out and replace the main valve bush of the 9½-inch pump by using a piece of 4-inch pipe, 5 inches long.

BILL HARDY,
Can. Pac. Ry.

Calgary, Can.

Butter as a Lubricant.

Editor:

I would like to ask R. J. L., of Baltimore, if he has tried butter on a rotary valve. I do not know what is best, but butter is good enough for me. I have used butter for two years and never have any trouble with a stiff-working rotary valve. I would ask some of your readers to try it before they ridicule the idea, and let me know how it works. I may be doing wrong in using butter; but I get it fresh, without any salt.

H. W. B.

Sparta, Tenn.

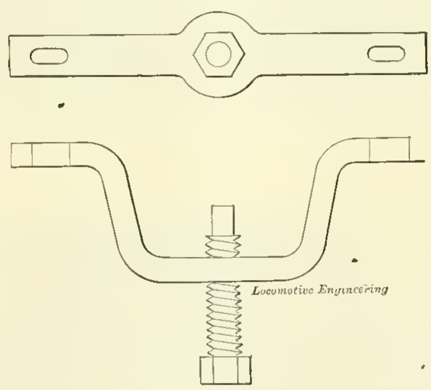
Device for Removing Air Piston Head from Rod.

Editor:

You recently illustrated a very excellent device for removing a pump air piston from the rod, but I am sending to you a sketch of one that is claimed to be better. It was devised and is being used by Mr. Cutler, air-brake repairman in the Livingston shops of the Northern Pacific Railway.

As the pumps pass through the shop, one of the holes originally provided in the air piston is tapped out for a bolt, and another is made on the opposite side and equidistant from the rod pole.

The superiority claimed for this device is that the steam head does not have to be



DEVICE FOR REMOVING AIR PUMP PISTON FROM ROD.

taken off in order that the air piston may be removed, thus effecting a material saving in time where air piston packing rings only are to be replaced.

The bolt holes through the clamp are slotted so as to require less accuracy in locating those in the pistons. By sufficiently extending one of the clamp feet, one of the pump head bolts could be made to prevent the piston from turning. However, the clamp employed when removing the piston rod nuts answers the same purpose.

F. B. FARMER.

St. Paul, Minn.

The Central Railroad of New Jersey is having built for its use twenty-five additional passenger cars and 2,200 freight and coal cars for spring delivery. During the past two years the company has had built and delivered 4,500 freight and coal cars and fifty-six locomotives. The effect of this new equipment is already reflected in a steady increase in the average tons per train-mile, which has recently run as high as 480, the largest in the company's history; hence additional new equipment.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(139) S. R. A., Lafayette, Ind., says:

1. What should be the length of the reversing piston stem in the 8-inch pump? A.—1. The stem should be 2¼ inches in length. 2. Will shortening the stem of the reversing piston stop the pounding in the pump? A.—2. The length of the reversing piston stem should never be changed from standard. If there is a pound in the pump it is due to something else.

(140) B. R. J., Camden, N. J., writes:

Is the preliminary exhaust port in the D-8 brake valve the same size as that in the F-6? There is a difference of opinion here, and we want you to decide. A.—Until two or three years ago the preliminary exhaust port in the D-8 (1890 model) was 3-32 inch in diameter. It was then changed to correspond with the F-6 valve (1892 model), in which the same port is 5-64 inch in diameter.

(141) A. B. L., Decatur, Ala., writes:

Why was the old hose coupling that had the nut on the back changed? The nut held the rubber gasket in place. The new one has no nut and the gasket is harder to get in and may not stay. A.—The solid-backed hose coupling head, having no threaded fit as did the other form, eliminates the liability to leakage at the nut. The construction is much simplified. The gasket once in its groove will stay there. By collapsing the coupling gasket sidewise between the thumb and forefinger, entrance into the groove may be quite easily accomplished.

(142) B. H., Calgary, Can., writes:

Would you tell me what you think to be the best lubricant for rotary valves? I have been using mutton tallow. A.—What will prove a good lubricant for a rotary valve depends very largely upon the usage the brake valve gets and the kind and quantity of oil used in the air cylinder of the pump. Under normal conditions, mutton tallow, or mutton tallow mixed with a little beeswax, will give as good service as any lubricant; but where the gummy deposit from the pump reaches the rotary valve, and the brake valve is much used in the emergency position, no lubricant will be able to make the rotary valve work easily and smoothly.

(143) D. M., St. Thomas, Ont., writes:

In the second paragraph on page 32 of the Proceedings of the Seventh Annual Convention of the Air-Brake Association, it says: "Owing to greater leakage at low temperature, more trouble results from overcharging by brakes creeping on than at high temperature." Please explain cause of greater leakage due to low temperature. A.—This statement may at first seem strange and unwarranted, but experience has proved that train pipe leakage is greater in cold, winter weather. Part of this is due to contraction in the iron piping and consequent distortive action upon the joints, and a greater part is due to the frozen rubber gaskets in the hose couplings, which fail to make as good joints when frozen hard as when warm and pliable Frozen hose, becoming rigid, will partly pull apart when the train is stretched, thereby causing a very considerable leak also.

(144) T. L. J., Long Island City, N. Y., writes:

Every year, about this time in the fall, we have slid-flat wheels under our coaches. It is the only time during the year that we have this trouble. We get a great many dead leaves on the track. Would that cause it? A.—Yes. The dead autumn leaves are greasy and break adhesion between the wheel and the rail the same as slippery mud or other like substance. Besides this, the fog and heavy sea atmosphere aggravate your trouble. The better way to avoid it is to make a ten or twelve-pound initial reduction in applying your brake, and slow down to ten or twelve miles an hour. Then release, but don't re-charge, and make the last part of your stop with a low auxiliary reservoir and brake cylinder pressure.

(145) F. O. C., Albany, N. Y., writes:

In facing a rotary valve down to its seat, I always find the seat worn rounding. The valve is the same way. The middle is higher than the outside edges. Why is this? A.—The rotary valve, in rotating, will cause its outside edge to travel faster and farther than the inner points. Thus there is more wear. Although the two surfaces are rounded, that is, high in the middle, the main reservoir pressure on the back of the rotary will spring it and force it into contact with the seat. When the pressure is off, however, there is a very perceptible "rock" to the valve which causes surprise that the surfaces were at all air tight. The greater wear at that portion of the valve having the greatest travel is similar to the greater wear at the larger part of the taper plug in an ordinary cock. The greater bearing is always on the portion having the least travel.

(146) B. E. R., Terre Haute, Ind., writes:

Several years ago, when the equalizing discharge valve was first used, the equalizing piston would flutter. The valves we got in late years don't do this. Is the valve the same? Please answer and settle a dispute. A.—The C-7 (1888 model) and some early D-8 (1890 model) valves used to "flutter"; that is, when a reduction was made in chamber D the equalizing piston would rise, and instead of remaining up, until it finally seated after a train-pipe discharge, would vibrate or flutter, ultimately seating. The vibrations, or flutterings, were greater upon the piston's initial lifting, and less as the position approached its seat at the finish of the train-pipe discharge. All valves of these above-mentioned types did not flutter, and none of the later valves were ever known to do it. When a valve did flutter, the piston was found to be in prime condition with a marvelously free working piston. The friction of the ring against the walls of the cylinder was almost nothing, and the momentarily differential pressures on the opposite sides of the piston were sufficient to cause a rebound at the limits of the stroke to set up the vibration which finished when the piston seated.

(147) C. J. T., Bloomington, Ill., writes:

Why is the port made so small in the case of the retaining valve? I notice some of the older valves have much larger openings, but the newer ones have much smaller port. I would think it would stop up. Please explain. A.—The standard and more recent valve has the port made smaller for the purpose of retarding the exhaust of air from the brake cylinder through the retaining valve. Thus the valve is not only a retaining valve but a retarding valve as well. Its increased efficiency will be readily recognized. All pressure over fifteen pounds will lift the weighted valve and escape through the small port until fifteen pounds only remain which is retained. But about a half a minute is required by the small port to reduce from fifty to fifteen pounds. There is no trouble experienced from the port stopping up.

Siberian Railway Overloaded.

Chief Engineer Perrin, an American who has been in the service of Russian capitalists who are developing a new coal mining enterprise in far-eastern Siberia, has arrived in Moscow. He says that work has entirely ceased until the situation in China improves.

"On my return journey," he says, "I met *en route* to Siberia fifty crowded military trains bound for the Far East. Passenger and freight traffic over the Siberian railway has been greatly delayed and has partly ceased on account of the pressure on the line for military purposes. Travel, consequently, has become very tiresome and unpleasant. The expense of living in Siberia is very high, all prices being much raised. The hotels are besieged by demands for shelter far beyond their capacity and Siberia has become a vast bivouac. All along the Russo-Chinese borders the white residents have armed themselves in readiness for any emergency. Foreign refugees from China are pouring into Vladivostok, Irkutsk and the other larger cities along the railway while troops are continually arriving on their way to China.

"The Manchurian railway works have been resumed after a considerable interruption. The war damage to the Manchurian extension of the Siberian railway has been great, and the claims for indemnity will have to be high. The losses amount to many millions of rubles. Furthermore, it is very unfortunate that the near completion of the line to a connection all across Asia should be thus deferred.

"A novel feature of loss is that the shipments of goods on their way to the great fair at Nijni Novgorod have been so much delayed by the use of the railway equipment for military purposes that the merchants, the fair and the whole connected trade will suffer a great deal. The Siberian merchants have handed Minister Witte a collective petition requesting that all cars loaded with goods for the fair be given immediate right of passage, without delay, through to European Russia.

"The trips of American and foreign tourists into Siberia by way of the great railway have entirely ceased."

The Corliss Engine.

The large Corliss engine that was such an attraction at the Centennial Exposition at Philadelphia in 1876 was set up at Pullman in 1880, and has been in active service ever since.

To those who saw it in 1876 this mention will recall an engine that was one of the features of the Exposition; but of the generation now coming up, but very few have seen it.

It is of 2,500 horse-power, but at present it is not worked to its full capacity, only about 1,100 horse-power being developed. It is a double engine with two cylinders of 40 inches in diameter, 10-foot stroke, simple, condensing. Running at one-eighth stroke cut-off, it develops 1 horse-power for each 15 pounds of water evaporated per hour—just about one-half what ordinary simple engines of to-day are doing.

Since this engine was first started, over twenty-four years ago, it has had very few repairs. One of the steam jackets has been replaced, one of the cylinder heads cracked and was replaced, and two new spiders for steam pistons have been put in.

This is a very good record for this machine. Possibly if it had been worked "down in the corner," like a locomotive on a grade, it would not have run so long without repairs.

Something New in Castings.

What appears to be a new departure in the casting line is the "graphitic steel castings" which Mr. Wm. B. Smith, of the Graphite Metal Company, is putting on the market.

These consist of castings containing considerable carbon, but with the greater portion of this changed into free graphite by a chemical process. This renders the castings tough, strong and malleable, and also allows them to be tempered if desired. The presence of this graphite is said to prevent the vibrations that cause the crystallization which plays havoc in steel and iron generally. It promises to cut quite a figure in the railroad field in the near future, and we hope to have accurate details a little later.

Some Old Mason Engines.

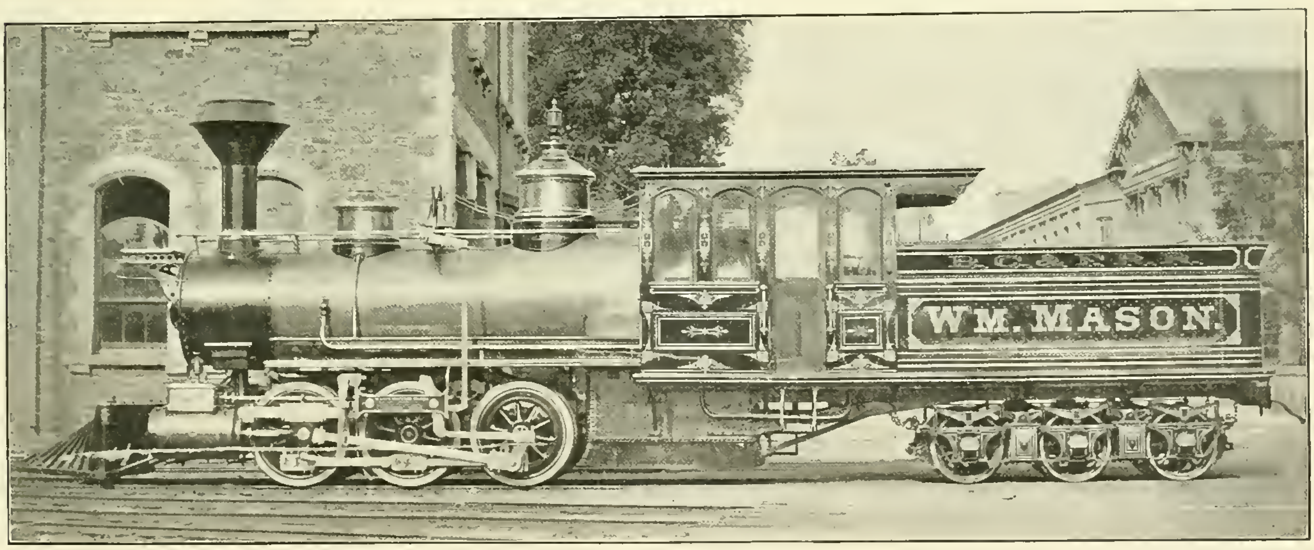
One of our friends in Taunton, Mass., Mr. Herbert Fisher (who was formerly employed by William Mason), has favored us with a few photographs of the old Mason engines, together with a brief description and dimensions. These are taken, as far as possible, from the records of the Mason Locomotive Works, and are evidently authentic. Those who ran the Mason engines generally had a good word for them, and to many of our readers these pictures will revive memories long since forgotten. A short description of each engine follows:

The "William Mason" was built for the Boston, Clinton & Fitchburg Railroad, now part of the New York, New Haven & Hartford Railroad. It was the first engine built by Mr. Mason to have the "Walschaert" valve motion. Cylinders, 16 x 24 inches; weight on drivers, 33 tons 600 pounds; boiler, 48 inches; weight on trucks, 26 tons 100 pounds; drivers, 3 feet 6 inches; tumbler shaft at top of boiler. There is possibly no engine to-day, of her dimensions, that could, under the conditions of her day and time, equal this engine for the amount of work done. Had she not been a bogie of old design, the late J. N. Lauder would have repaired her. She was broken up. Her boiler is in the Taunton yard of the New York, New Haven & Hartford Railroad. The engine could haul 125 long box freight cars, such as were used at the time between Mansfield and Fitchburg, and the grades were heavy; so Mr. Hobart Piper, her engineer, informs us.

The "White Haven" was one of the first ten-wheelers of the Lehigh Valley Railroad; built in 1863. Cylinders, 17 x 24 inches; boiler, 48 inches diameter; drivers, 4 feet; cylinders inclined; no record of weight.

The double-ender, "Janus," was built in 1869 or 1870. Cylinders were 15 x 22 inches; boiler, 44 inches diameter; drivers, 3 feet 6 inches. This engine was sold to the Lehigh Valley Railroad, and is now in the scrap. She was used to push heavy trains up grade. The late Mr. Mason declared he would never build another, as the coal and water space was not sufficient to make them practical; but she had considerable push, all the same.

A DOUBLE-ENDED PUSHER FOR THE LEHIGH VALLEY ROAD IN ABOUT 1869.



MASON'S FIRST ENGINE WITH WALSCHAERT VALVE GEAR.

Engineering Progress in the British Navy.

After much discussion and misgiving, the British Admiralty, which is the authority in charge of the British Navy, began using steamships about 1836. At that time the boiler pressure of steam employed was 4 pounds per square inch, and this represented the prevailing practice till about 1843. Steam of this pressure was generated in the flue type of boiler. At the date mentioned tubular boilers began to come into use, and about 1850 the steam pressure rose to from 10 to 12 pounds to the square inch. Between that date and 1860 a further rise of pressure went on till it reached about 20 pounds to the square inch.

THE SURFACE CONDENSER.

About 1860 the surface condenser was introduced. Up to that date the jet condenser was used, in which the exhaust steam was condensed by a jet of water being sprayed into a vessel into which the steam passed on leaving the main cylinder. The vacuum formed in the cylinder by condensing the exhaust steam was in the early days the principal element of power. The boiler feed water was taken from the condenser, but it was very little softer than sea water. When the surface condenser came into use, it prepared the way for much higher steam pressure, because the feed water was then free from the impurities that with sea-water feed covered the boiler-heating surfaces with incrustation. The benefits resulting from the use of high-pressure steam in marine engines would have been impossible had not some such contrivance as the surface condenser been brought into use. But for that invention the voyage from New York to Liverpool would still be lasting about two weeks.

Before the surface condenser was brought into use, very little of the expansive power of the steam was utilized, for the cylinder pressure was so low that there was little expansive power to make use of. On this account the coal consumption was very high per unit of power developed. But with the surface condenser came higher pressures, steam jackets for cylinders, superheaters and greater expansion, which made a fairly economical engine. Until the compound engine was introduced the boiler pressure rarely exceeded 30 pounds per square inch.

COMPOUND ENGINES.

Many steamers belonging to the mercantile marine were using compound engines with success, and the navy had to follow suit. Great diversity of opinion—or rather opposition, not to mince the truth—existed among naval men as to the value of the compound. They did not wish to have anything to do with it; but public opinion forced the Admiralty to try the compound, and they did so; but it proved a failure, as might have been expected. Several compound engines were put into ships and worked a few months, then were taken out. The force of prejudice made them unpopular; but the steam pressure was only 35 pounds, so there was not much expansive power to call for the use of a second cylinder. The navy men were contented for twelve or fifteen years to abuse the compound engine and sneer at the steamship engineers outside of their aristocratic circle for tolerating compound engines; but the owners of merchant steamers had to look after keeping down expense of fuel bills, and so the compound steadily made its way into favor among them. Towards 1872, when nearly all merchant steamers were using compound engines and the navy had none, an investigation was made by Parliament. At this investigation evidence was given that compound engines working with 60 pounds pressure effected a fuel saving of from 30 to 35 per cent. over the simple engines using 30 pounds pressure. After that was shown, the British Navy adopted the compound engine, and steam pressures were gradually increased until 120 pounds was reached. That was about 1883.

The naval authorities seemed to think that they were moving ahead at a tremendous rate, but about this time they were disgusted to learn that some of the hated merchant steamers had gone in for triple-expansion engines. The navy did not invite another Parliamentary inquiry, but reluctantly adopted the principle of triple expansion. The prevailing boiler pressures were then ranging from 150 to 200 pounds per square inch.

About this time somebody in the British Navy came to believe that his associates had been slow-moving, and he concluded that the use of water-tube boilers was necessary in the navy. They started off at a tremendous pace, which landed them upon the Belleville boiler. What came of this extraordinary rush of progress is another story.

ONE OF THE FIRST TEN-WHEELERS OF THE LEHIGH VALLEY ROAD; MAIN DRIVERS AHEAD.

Lecture on the Chemistry of Iron and Steel.

Mr. H. F. J. Porter, of the Bethlehem Steel Company, of South Bethlehem, Pa., gave a very interesting illustrated lecture before the Brooklyn Institute of Arts and Sciences on November 20th. His subject was the "Development of the Forging Industry," and he showed pictures of steel tools found in Assyria which were made 1500 B. C., also a picture of the oldest piece of iron known, and taken from the Pyramid of Cheops, and which is now shown in the British Museum. He also said that iron was known in Persia 1100 B. C.

After describing and illustrating specimens of ancient iron, many of which were in the form of helmets and breast plates, Mr. Porter showed the different methods of making iron up to the present day as used at the Bethlehem Steel Works, and his next lecture will show all the processes in use there.

Our occasional correspondent, Mr. John H. Goodyear, who has been for the last few years assistant general superintendent of the Buffalo & Susquehanna Railroad, has resigned, his work of systematizing the various departments of the road having been completed. Mr. Goodyear would make an excellent assistant to any general manager who wishes to be relieved of routine duties.

Personal Department.

Mr. L. S. Miller, of the Erie, has been appointed assistant to President Thomas.

Mr. O. G. Cheatham has been appointed general foreman of the Southern shops at Spencer, N. C.

Mr. Oliver Galbraith has been appointed master mechanic of the Paragould Southeastern at Paragould, Ark.

Mr. J. A. Dodson has been appointed general superintendent of the Alabama Great Southern at Chattanooga, Tenn.

The office of Purchasing Agent F. P. McIntyre, of the Mexican Central, has been removed from Boston to 52 Broadway, New York.

Mr. D. H. Speakman has been appointed general foreman of the Chicago, Rock Island & Pacific at Horton, Kan., vice Mr. T. E. Merritt, resigned.

Mr. T. H. Fitzpatrick has been appointed superintendent of the Nevada-California-Oregon at Reno, Nev., succeeding Mr. E. F. Smith, promoted.

Mr. R. A. Moore has been appointed master mechanic of the Wrightsville & Tennville at Tennville, Ga., succeeding Mr. J. H. Green, resigned.

Mr. W. S. Carson has been appointed trainmaster of the Atchison, Topeka & Santa Fé at Kansas City, Mo., vice Mr. F. H. Russell, transferred.

Mr. F. P. Hickey has been appointed general foreman of the Atchison, Topeka & Santa Fé at Topeka, Kan., succeeding Mr. F. J. Gunther, resigned.

Mr. S. H. Brown, trainmaster of the Chicago & Northwestern at Baraboo, Wis., has been transferred to Clinton, Ia., succeeding J. A. Sellers, deceased.

Mr. J. M. Opley has been appointed trainmaster of the Chicago, Milwaukee & St. Paul at La Crosse, Wis., succeeding Mr. W. B. Foster, transferred.

The headquarters of S. M. Braden, division superintendent of the Chicago & Northwestern, has been removed from Belle Plaine, Ia., to Mason City, Ia.

Mr. J. H. Elliott has been appointed trainmaster of the St. Louis & San Francisco between Springfield and St. Louis, with headquarters at Springfield, Mo.

The jurisdiction of Mr. A. O'Hara, superintendent of the St. Louis & San Francisco at Springfield, Mo., has been extended over the St. Louis division.

Mr. C. E. Riford has been appointed traveling engineer of the Middle and Western districts, Wyoming division, of the Union Pacific, vice Mr. M. Birney, resigned.

Mr. Robert H. England, general manager of the Dansville & Mt. Morris, has also been appointed general manager of the Marietta, Columbus & Cleveland, at Marietta, Ohio.

Mr. E. A. Kellogg has been appointed assistant division superintendent of the Iowa division of the Chicago & Northwestern at Boone, Ia., vice Mr. M. F. White, resigned.

Mr. James O. Goodwin has resigned as foreman boilermaker of the Rogers Locomotive Works to take charge of the boiler shop of the Richmond Locomotive and Machine Works.

Mr. G. H. Saunders, trainmaster of the Atchison, Topeka & Santa Fé at Newton, Kan., has been transferred to the Chicago division at Chillicothe, Ill., succeeding C. L. Short, resigned.

Mr. Oscar Autz, general foreman of the car department of the Lake Shore & Michigan Southern, has been appointed general foreman of the locomotive department at Elkhart, Ind.

Mr. W. B. Foster, trainmaster of the Chicago, Milwaukee & St. Paul at La Crosse, Wis., has been transferred to Perry, Ia., vice Mr. G. R. Morrison, transferred to Savanna, Ill.

Mr. Charles M. Hays, general manager of the Grand Trunk, has been chosen president of the Southern Pacific, succeeding the late C. P. Huntington; headquarters at San Francisco, Cal.

Mr. C. G. Potter, master mechanic of the Nashville, Chattanooga & St. Louis at Paducah, Ky., has resigned to accept the position of traveling engineer of the Lake Erie & Western at Lafayette, Ind.

A report is current that President McKinley has offered the directorship of the Bureau of Engraving and Printing to Mr. Fredk. P. Sargent, grand master of the Brotherhood of Locomotive Firemen.

Mr. G. E. Thorne has been appointed trainmaster of the Ft. Worth & Denver City at Wichita Falls, Texas, succeeding Mr. M. H. Mills, promoted to the position of assistant to the general superintendent.

Mr. G. R. Huntington, superintendent of the Wisconsin & Peninsula division of the Minneapolis, St. Paul & Sault Ste. Marie, has been promoted to the position of general superintendent at Minneapolis, Minn.

Mr. Elmer J. Hufford has been appointed road foreman of engines of the Eastern division of the Chicago & Alton, with headquarters at Bloomington, Ill. He succeeds Mr. F. S. Miller, assigned to other duties.

Mr. A. L. Moler, late general foreman for the Chicago & Alton Railroad at Chicago, has been appointed superintendent and master mechanic of the Macon, Dublin & Savannah Railway, with headquarters at Macon, Ga.

Mr. D. Witherspoon has been appointed master mechanic and master car builder of the Washburn, Bayfield & Iron River at Washburn, Wis. He was formerly general foreman of the Baltimore & Ohio at Connellsville, Pa.

The whereabouts are wanted of Engineer Pelham, who invented the Pelham driver brake release. When last heard from he was running on the M. K. & T. If anyone will send his present address to this office, his kindness will be appreciated.

Mr. F. W. Curtis, assistant superintendent of the Minneapolis, St. Paul & Sault Ste. Marie at Enderlin, N. D., has been promoted to the position of superintendent of the Wisconsin & Peninsula division at Minneapolis, Minn., vice Mr. G. R. Huntington, promoted.

Mr. Frank C. Cleaver, master mechanic of the Louisville, Evansville & St. Louis at Princeton, Ind., has resigned to accept the position of superintendent of motive power and car department of the Wisconsin Central at Waukesha, Wis., vice Mr. Angus Brown, resigned.

Mr. J. M. Walsh, trainmaster of the St. Louis, Iron Mountain & Southern, has been appointed acting superintendent of the Central division, with office at Little Rock, Ark., and Mr. T. D. Coppage has been appointed trainmaster at Little Rock, to succeed Mr. Walsh.

Mr. Francis J. Cole, mechanical engineer of the Rogers Locomotive Works, has resigned to accept a similar position with the Schenectady Locomotive Works. Mr. Cole started as an apprentice, in 1877, in the machine shop of the Northern Central division of the Pennsylvania, where he afterwards was made draftsman. He worked his way up till he became mechanical engineer of the Baltimore & Ohio, which position he left in 1895 to go with the Rogers Locomotive Works.

On November 1st Mr. W. H. Peddle was appointed assistant general manager, with headquarters at Washington, D. C.; J. H. Barrett was made general superintendent of transportation, with office at Washington; Joseph H. Sands was appointed general superintendent of the Eastern district, with headquarters at Salisbury, N. C.; John A. Dodson will be general superintendent of the Western division, with headquarters at Chattanooga, Tenn.; D. W. Lum will be engineer of bridges and buildings, with office at Washington; William H. Green is assistant manager, and will have charge of the United States mail, dining-car service, fuel and real estate.

Mr. A. J. Frazer, superintendent of the Birmingham division of the Southern Railway, has been appointed superintendent of the Alabama Great Southern, with headquarters at Birmingham, Ala., in place of Mr. C. A. Wickersham, resigned. Mr. C. S. Hayden, superintendent of the Mobile division of the Southern Railway, has been appointed superintendent of the Birmingham division at Birmingham, in place of Mr. Fraser, and Mr. W. N. Foraker, trainmaster of the Atlanta division, has been appointed superintendent of the Mobile division, with headquarters at Selma, Ala., to succeed Mr. Hayden. Mr. C. C. Hodges, chief train dispatcher at Atlanta, has been appointed trainmaster of the Atlanta division at Atlanta, Ga., in place of Mr. Foraker, promoted.

Mr. Jos. H. Williamson, who for nearly eighteen years has been the business manager of the manufacturers' Advertising Agency, New York city, desires to announce that he has severed his relationship with that company to connect himself with the old-established Viennot Advertising Agency, 524 Walnut street, Philadelphia, as its business manager, in the place of Mr. Thompson, resigned. Mr. Williamson also desires to express his appreciation of the uniform courtesy extended to him by his many friends in the trade paper and general advertising field in the past, and will be glad to welcome them at any time at his new address, either at the office in Philadelphia or at the New York office of the Viennot Advertising Agency, 127 Duane street, Graham Building.

Mr. James L. Taylor has been elected third vice-president of the Consolidated Railway Electric Lighting and Equipment Company. He was until recently the general European agent of the Pennsylvania in London, and previously had a railroad experience in this country, having served in prominent positions on the lines forming the Plant and Southern Railway systems, before entering the service of the Pennsylvania. He is well and favorably known in this country as a railroad man; and, during his residence abroad, attained an enviable position in the social and railway world. He was president of the American Society in London, and delegate to the International Railway Congresses in London and Paris. He was connected with the American Commissions at both the Brussels and Paris Expositions, and for his services at the first named he has the decoration of the Order of Leopold.

Oil Inspection.

In a number of the States of the Union there are laws which require the inspection and testing of all oil used for illuminating purposes with a high-degree fire test, to make sure that no low-test oils are sold which are liable to explode and injure property or the person of the consumer.

The apparatus for making the ordinary test is quite simple, and but a limited amount of skill is necessary to use it. As there is a fee for each barrel tested, the position is sometimes only a sinecure.

In Michigan the oil used in the lamps of passenger cars must stand a test of 300 degrees. This oil does not burn very readily unless the lamps are fitted to use it, and does not give as good a light as the lower test oil, which must stand 125 degrees.

The oil inspector for the Railroad Commissioner made regular tests of the oil used in passenger train cars and reported quite a number of the companies using the low-test oil contrary to law. When called on to explain this to the Commissioner, an indignant reply was made, to the effect that they bought mineral seal oil of the legal test for all their passenger equipment and used it, and that the inspector did not know his business. This brought it up to the inspector, who visited each one of the offending companies, took a sample of oil from the baggage car lamps, tested it in the presence of the officials, and proved that his report was correct. This of course carried the day for him, and he then explained that because the high-test oil would not burn in the old lamps made for low-test oil, the trainmen carried a special can, and, after throwing out the high-test oil, filled the lamps with low-test.

Of course the supply of low-test oil was at once cut off. In some instances new lamps were supplied.

Kerosene oil of whatever test is dangerous for use in passenger cars, on account of the liability of fire in case of a collision; but we have not got the perfect and economical substitute for it on small roads with small earnings, and until that day is reached we must be content with oil.

The car that is most liable to be smashed up in a collision is the mail car. As the mail cl rks spend long hours there, it is not unusual to see cooking apparatus in them—more often an oil stove, which is a menace to the clerk in case of an accident while it is lighted.

Possibly some of the fires that start in the ruins of a steam-heated train at the instant of a smash-up can be traced to the use of low-test oil, contrary to instructions.

ERECTING COMPOUNDS AT VICTORIA BAY FOR CHINESE EASTERN RAILWAY.

Wide vs. Narrow Fireboxes.

In connection with the controversy in regard to large grate area there are a few questions that can be asked of the advocates of the "barn door grate," as some of the boys call it. If slow combustion is a good thing, why are stationary engineers reducing their grate areas and putting in forced draft?

I took a ride on one of the big Mother Hubbards on the Lackawann a few months ago, and as I used to run over this road years ago, I watched her pretty closely. There were only six cars on, and yet she dragged up Pocono like a freight train, not a bit faster than the old engines used to—though of course the cars were lighter then.

A glance at the reverse lever showed the reason. He was working her up close to center, and keeping one eye on the steam gage at that. We used to work them down pretty near the corner and bang it to them. If these engines had less grate surface and could carry a thicker fire so it would not be torn to pieces when they are worked for all they are worth, they would do better work. I don't think it's the fault of these particular engines—there are others just like them on the Jersey Central; but I do believe they would do better work with a smaller grate, that could be worked hard on the hill. FRANK C. HUDSON.

Tombstone, Arizona.

Notes From Chinese Railways.

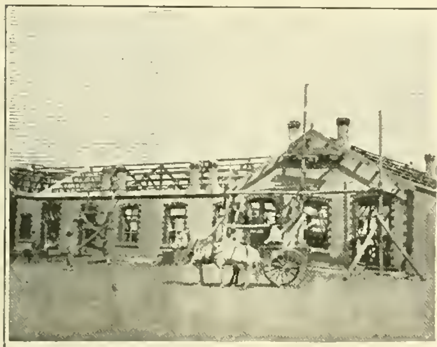
BY H. B. FISHER.

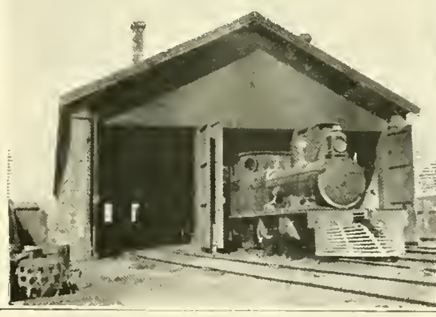
Having finished the last of an order of twenty Baldwin compound consolidated engines for the Chinese Eastern Railway at Talienwan, I left for Vladivostock by steamer bound for the latter port *via* Tong Koo and Che Foo, September 21st. We arrived off Ta Koo at noon on September 22d, passing through the largest fleet of foreign warships perhaps ever assembled. I counted over sixty warships and transports, then gave it up. At 4 P. M. we passed the Ta Koo forts at the mouth of the Pei Ho River. Those on the right were the ones that opened up on the foreign gunboats at anchor. A mile or two above the river is narrow and very muddy. We reached Tong Koo at 5.30 P. M. and tied up at the dock. The American flag is quite conspicuous along the east bank for a mile or two; and opposite, on the west bank, there were several hundred coolies digging a winter berth for the old "Monocacy," which I am told would go into winter quarters there.

Tong Koo is the beginning of the railway to Tien-Tsin and Pekin, and is a very busy place, with troops and army supplies for the winter, which is long and very severe. The country is very flat, without a tree in sight.

Being told it would require two days to discharge our steamer, and fares on the Imperial Chinese Railway make travel possible, as they are not collecting, nor charging anything at present, so everyone rides. There are three trains each way a day between Tong Koo and Tien-Tsin (27 miles). The gages are standard, and the engines are Dubbs, Baldwin and Rogers. The coaches are of the American pattern, but with compartments, and there are two classes. I am told this road paid very well. We left at 9 A. M., passing through the Chinese part of Tong Koo, which had been entirely destroyed by the foreign troops. Our speed was slow, as they were laying sleepers, replacing those that had been removed by the Boxers. All the section houses along the line were in ruins, and at the bridges all the woodwork that could be destroyed was either removed or burned. One iron bridge across a small river had been blown up, and we crossed on piles of sleepers. We could see in the distance the Poo Tung forts, which were taken by the Germans and Russians a few days before.

Within two miles of Tien-Tsin we passed a Rogers mogul which had been derailed by the Russians, and the jacket and cab were perforated with 1-pound shot. One large shell pierced the boiler. The railway yards of Tien-Tsin are full of burned cars, and the engine shed is full of shot holes. The station opposite was entirely destroyed, but is being rebuilt. I am told this was the point of the most severe fighting, as the Chinese were back of the engine house with their large guns and also at an arsenal on the left. Near the river there are immense salt heaps, behind which the Chinese fired on the French quarter of Tien-Tsin, and which is now in ruins. I have taken a few photographs, which I enclose. The Chinese are gradually returning and the town is full of troops. I called on Mr. Kinder, the former pioneer and manager of the railway. I found him a very pleasant gentleman. He was there during all the trouble, and is waiting for his road to be turned over to the original owners. He has several new English engines stored at Shanghai till the trouble is over. I was informed by him that several of the tanks and trucks of engines between Tien-Tsin and Pekin have been taken away by the Chinese and can't be found. Their roadbed seems to be in good condition, with stone ballast and a good rail.





TIEN-TSIN STATION BEING REBUILT.
FRENCH TROOPS AND SUPPLIES ARRIVING IN TIEN-TSIN.

CARS BURNED BY THE BOXERS.
ENGINE SHED RIDDLED BY THE CHINESE.

RAILWAY WATER TANK PIERCED BY SEVERAL LARGE SHOT.
PASSENGER COACHES BURNED BY BOXERS.

Exports of American Iron and Steel.

The extraordinary increase in the exportation of products of the iron and steel trades of this country is shown by the following statistics: For nine months ending September 30, 1890, the value of the exportations was over $19,000,000. For the same term in 1895, nearly $25,000,000, and for 1900 a record breaker of over $97,000,000 was made.

What is said to be the heaviest and strongest railroad bridge in the world is now being built by the Carnegie Steel Company. It will cross the Monongahela River six miles above Pittsburgh, and will connect the company's works at Homestead and Braddock. Over it will be hauled trains of enormous weight, loaded with melted iron, iron ore, pig iron, coke and limestone, and two such trains can pass each other on it in safety. The bridge will be 2,300 feet long, and on it will be laid two railroad tracks and a sidewalk. In its make-up will be some of the largest pieces of steel ever used in bridge building.

Cut-off in Indicator Work.

BY G. W. WILDIN, PLANT SYSTEM OF RAILWAYS, SAVANNAH, GA.

The columns of LOCOMOTIVE ENGINEERING have for many years past been a veritable encyclopedia of reference upon all questions in connection with the steam engine indicator and its relation to the valve gear of locomotives and steam distribution.

The writer is free to confess the fact that he received his first impetus to make a study of this subject through the perusal of its columns. As chairman of the committee appointed to look after the progress of indicator work and report to the Traveling Engineers' Association at their next annual convention in September, 1901, I would like to be granted a little space in its columns in which to make a few remarks upon a certain feature of indicator work which I feel as a rule is not presented in the most perspicuous form.

Traveling engineers are practical men rather than theoretical, and do not care to take upon themselves work which would involve intricate mathematical calculations, and they should not be expected to do so. What we ought to do, though, is to thoroughly understand each other, to get together and agree upon the terms, phrases and methods we are going to employ when we begin our work, in order that when we record a fact it will be understood as thoroughly by others, as we understand it ourselves.

All records in indicator work should carry with them no case of doubt whatever, they should be so expressed that one and only one meaning can be applied to them, and not be a jumbled mass of ambiguous terms, capable of many interpretations. The feature of indicator work, which I wish to call attention to in this article, is that of noting the cut-off while taking cards. The usual form of noting this particular event of the stroke when taking cards from a locomotive is very unsatisfactory and indefinite—at least, to my way of thinking.

In stationary work it is customary to designate the cut-off at the time a card is taken in ordinary plain "inches." For instance, we say that a certain card was taken with the valves cutting off at 12 inches. By this expression we mean that the piston has traveled 12 inches in the cylinder when the admission of steam is stopped by the valve closing the admission port.

The same practice should be followed in locomotive work, but instead, when we come to record the event in this branch of the work we express ourselves about as follows: Card X, boiler pressure 180 pounds, miles per hour 45, position of throttle wide open and cut-off third notch. Now who can tell from the data given concerning Card X the exact number of inches the piston has traveled when the admission is stopped, by the valve closing the port? This fact could be determined of course by placing the engine on rollers and catching the point with the tram, or, by laying out the valve gear of this particular engine upon the draughting board. The former method would be practical where the engine is to have the valves gone over any way, but, as to the latter method, the end would not justify the means. We will suppose another case. Assume Card Y taken from Engine 100, with data as follows: Boiler pressure 180 pounds, miles per hour 50, position of throttle full open, cut-off second notch, and Z taken from Engine 120 with data as follows: Boiler pressure 180 pounds, miles per hour 50, position of throttle full open, cut-off second notch.

RAILWAY CUT INTO THE NEW RUSSIAN COMMERCIAL PORT OF VICTORIA BAY.

We notice here that the conditions for the two cases cited agree in every particular, and yet we would not be justified in making deductions as to the merits of the two engines working in the second notch from the simple fact that while the valve gear might agree in all other particulars the notches in the quadrant of Engine 100 might be 3¼-inch centers and those of Engine 120 1¼-inch centers.

These examples are asumed merely as illustrations, and we might continue to assume, making slight changes, first in one part of the valve gear and then another, until our assumptions reach the hundred mark, but I think those cited will suffice for the purpose in hand. There seems to be no agreement whatever in quadrants of different builds of engines, either as to length, size of the notches or the relative distance from quadrant to reach-rod, or reach-rod to reverse lever fulcrum.

Every builder and every superintendent of motive power has his fad and his fancy and every engineman is familiar with the great diversity in design. It is very much to be regretted, especially by the indicator advocate, that there has never been a standard adopted, so that a given notch would mean a certain number of inches cut-off for all engines of a given stroke, regardless of the build.

As matters now stand, it is quite evident that but little real information is imparted by simply saying this or that card was taken while the reverse lever was in a given notch. In making the remarks I have it is not with the intention of advocating the abandonment of the practice of recording the notch in which the reverse lever rests at the time of taking the card, but to simply point out the fact that too much stress should not be placed upon the information obtained from that source, when comparing cards from two engines of different design. On the other hand, I wish to say we should always record the notch, for the following reasons: It is valuable when comparing cards taken from the same engine, and may be the means of avoiding some flagrant error. Instances occur quite frequently where cards with long cut-off and high speed are confounded with those of short cut-off and low speed. The likeness is very striking in some cases, and to one not accustomed to reading cards, it is easily misleading. This confusion of course cannot annoy even the amateur, if the notch is recorded.

As previously stated, I am strongly of the opinion that we should follow the same system in locomotive work as is followed in stationary practice, and give the cut-off for each card taken in inches and fractions of inches if it comes that way. Business and circumstances will not always permit one to graduate and stencil the quadrant of an engine before indicating it.

Relying upon my experience, I would offer the following as a course to be followed when preparing to indicate an engine. Should any of the readers of Loco-

MOTIVE ENGINEERING have a better or more economical plan, I would be pleased to hear from them, either through the columns of this paper or personally. When an engine is to be indicated, proceed as follows: Apply the indicator in the usual manner and take the cards, noting on each, along with the other necessary data, the notch the reverse lever rested in at the time the card was taken. Usually, if the right kind of an engine is indicated, some adjustment of the valve gear will be necessary, and the engine will have to be placed on rollers for the purpose. If the wrong kind of an engine should be indicated and the results doctored for exhibition purposes, there is usually behind the enterprise a motive actuated by a desire other than to impart real information, and the least said about such cards the better. In such a case don't look for the cut-off.

Having the engine on rollers, catch the cut-off with the tram before molesting the valve gear in any way, and note this cut-off in inches on the back of the cards you have taken. By so doing you not only have on the card the notch, but also the cut-off in inches, corresponding to that notch.

Now adjust your valves as best you can with the tram to what you think they should be, judging from the card you have taken. Then get the cut-off for each notch, and if the quadrant will permit it, stencil the proper cut-off under each notch; or it may be just as well to note the cut-off for each notch in a small book and file this book for reference. By so doing you have the information for all time to come. The time and labor required to determine the cut-off in this way are very little, while the convenience to one wishing to indicate the engine and calculate results is gratifying.

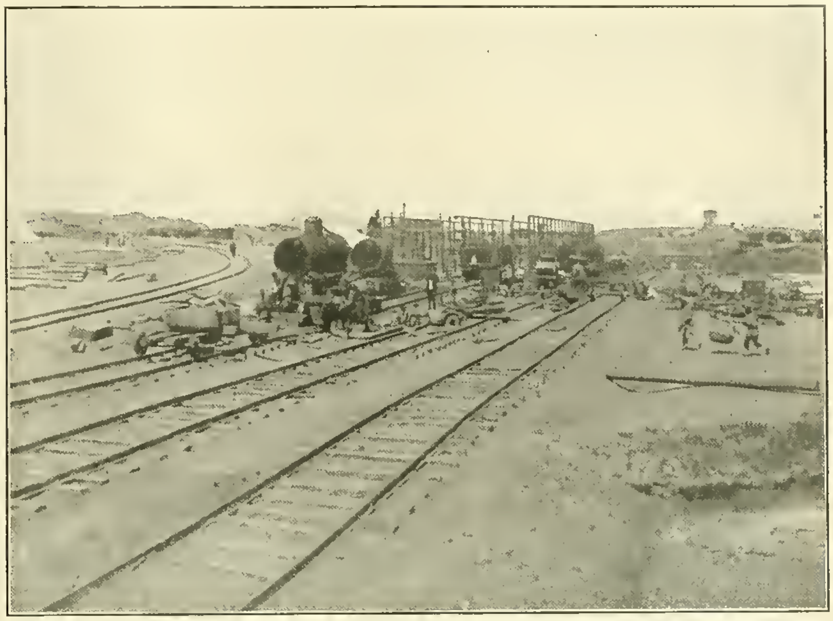
France Beating us in Train Speed.

A French train on the Northern Railway, the Paris-Calais Express, has broken the world's record, it is claimed, for long-distance running. On Saturday, October 27th, this train left the Gare du Nord, Paris, at 8 A. M. It reached the maritime station at Calais at 11.7 A. M. Allowing for the 2½ minutes stoppage at Longneau-Amiens, this new express (officially designated as the "B. L.") covered the 298 kilometers (185 miles) in 3 hours 4 minutes and 30 seconds, an average speed of nearly 100 kilometers per hour, or a little over a mile a minute. The engine was one of the latest models, invented by M. du Bousquet, chief engineer of the line, and hauled a baggage car and eight coaches. The train returned to Paris at the same speed, reaching the Gare du Nord at 6.45 P. M. It is claimed that no other train in the world approaches this performance. I should like to ask if some of our American trains have not come up to, if not beaten, a run like this. In addition to its Westinghouse brakes, this train is furnished with a new instantaneous brake, which is used to diminish the shock of a "slow-up" when the train is traveling at high speed.

Perhaps it may interest you to know that the fastest regular long-distance train in the world is the Sud Express, which even beats the Empire State Express, which the New York Central people always have claimed as the world's fastest long-distance train. This express runs regularly between Paris and Bayonne (486.25 miles) at the rate of 54.13 miles per hour.

You might think from this letter that I am a Frenchman, to take interest in their fast expresses, but I am not, and it grieved me very much to see these "parlez vous" getting ahead of us. The Empire State Express should get up a little sharper clip, and beat its French rival, to re-establish its reputation. E. H. BENDEL.

Geneva, Switzerland.



ERECTING BALDWIN COMPOUNDS AT VICTORIA BAY FOR CHINESE EASTERN RAILWAY.

DISCHARGING BALDWIN COMPOUNDS AT NEW CHWANG, NORTH CHINA, FOR CHINESE EASTERN RAILWAY.

The first statement of the Northwestern Elevated Railroad, of Chicago, made November 1st, gives the information that the total number of passengers carried during the month of October was 1,575,017, the daily average being 50,807. The business of all the elevated roads in Chicago showed a material increase over that of September.

The Greater Burlington.

Twenty-seven railroads lost their corporate existence and were merged with the Chicago, Burlington & Quincy at the November meeting of the stockholders. The absorption of these lines was part of a plan of this company to bring all the auxiliary roads that have been operated by the Burlington, under lease and otherwise, under one ownership and management; the idea being to consolidate and concentrate, financially and physically, the entire system.

The Automobile Magazine.

In the November number of LOCOMOTIVE ENGINEERING we mentioned that members of the Angus Sinclair Company had obtained control of the *Automobile Magazine,* and that they were publishing it in the office of LOCOMOTIVE ENGINEERING. That has brought us so many congratulations and kindly letters that we are almost moved to believe that many railroad men are preparing to jump from the locomotive and Pullman car to the automobile. However that may be, we feel certain that our numerous friends will rejoice with us in the knowledge that our new baby is in robust health. We expect to nurture him on the lines of a high-class magazine, where fun, romance and outing attractions will be mixed up with information concerning the proper way to handle automobiles. If the men who run the machines will follow the advice of our "Old Man," who is spending considerable time on his back studying the internal shortcomings and longcomings of automobiles, they are likely to absorb some lessons of experience.

This invaluable magazine is no exclusive monopoly. It can be purchased for a whole year for $3, if any of the usual forms of payment are sent to this office.

Boston & Albany Leased by New York Central.

The Boston & Albany Railroad having been leased to the New York Central, the mileage of the Albany road will now be added to that of the New York Central, and hereafter a 1,000-mile ticket of the New York Central & Hudson River Railroad will be good on the Boston & Albany Railroad. This will prove a great convenience to the traveling public who desire to reach points in Massachusetts on or reached *via* the Boston & Albany, including, of course, Boston.

The holder of a New York Central 1,000-mile ticket will now have the privilege of riding over lines aggregating more than 6,000 miles of railroad on a ticket costing only two cents per mile, good for the person presenting it and good until used.

RAILWAY CUT, LOOKING TOWARDS THE BAY.

The United States Grand Jury at Philadelphia has ignored the bills of indictment against Isaac A. Sweigard, who was formerly superintendent of the Philadelphia & Reading Railroad Company, and who was charged by the Brotherhood of Railroad Trainmen with having discharged employés of the Reading Company because they were members of the brotherhood.

The Rand Drill Company have removed their main office from 100 Broadway, New York, to the fifteenth floor of the new building just erected by the American Exchange National Bank at 128 Broadway, corner of Cedar street, to which place all future correspondence should be addressed. In its new office, the company will occupy the entire floor, in conjunction with its allied interests, the Pneumatic Engineering Company, the Rendrock Powder Company and the Davis Calyx Drill Company.

Portable Outdoor Forge.

The accompanying illustration shows an improved outdoor forge manufactured by the Buffalo Forge Company, of Buffalo, N. Y. The construction combines lightness, durability and capacity. The blast is furnished by a fan, the case of which is 12 inches in diameter. The blast wheel is driven by a crank through a train of accurately cut gears enclosed in a dust-proof case, providing ample blast. The air passes to the tuyere through a short blast pipe, a short downward branch of which provides an ash outlet. The circular bowl is 18 inches diameter and is fitted with a shield, as shown. The height of the forge over all is 44 inches, and its weight 115 pounds.

To facilitate packing and portage, the various parts, which are light as considerations of strength will consistently allow, are made detachable. Gears, fan case, bowl, standard and legs may be readily

PORTABLE BUFFALO FORGE.

separated and as quickly put together again; the design is such as to enable the parts to be assembled in two minutes.

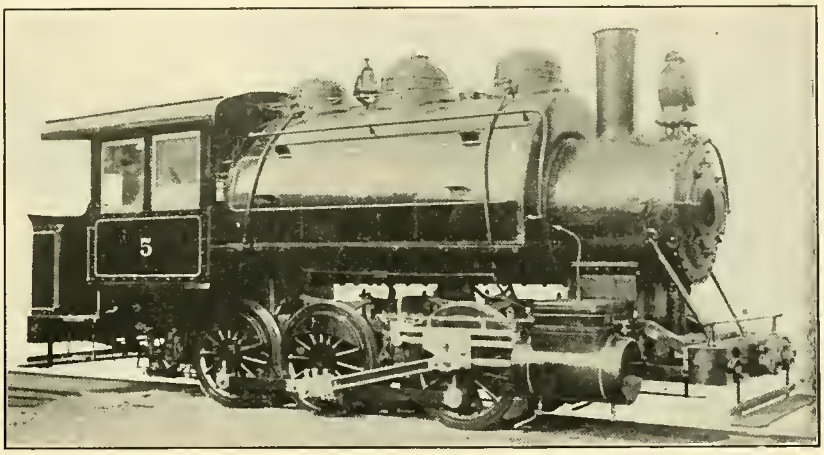
Owing to the extreme lightness of this forge and the readiness with which the various parts may be detached, it is a very handy piece of apparatus for outdoor use. For bridge builders, miners, railroad contractors, boiler-makers and steel construction workers, the forge is specially intended. They also manufacture a number of other portable outdoor forges for various kinds of work.

Some of the roads that formerly ran dining cars on the American or full-meal plan have changed to the European or pay-for-what-you-get plan. Recently a vote of the patrons of the Pennsylvania and Vanderbilt lines was taken to ascertain which plan was most popular. The vote decided that the American was greatly in favor, and will therefore be continued.

Dickson's Saddle Tank Locomotive.

The saddle tank locomotive here shown is one recently built by the Dickson Locomotive Works, at Scranton, Pa., for Messrs. M. Guggenheim's Sons, Mexico.

The engine weighs 109,600 pounds in working order and has cylinders 18 x 24 inches, with drivers 50 inches diameter. The total wheel-base is 10 feet. The boiler is straight, 56 inches diameter at the smallest ring and carries a working pressure of 180 pounds. The firebox is 74 inches long, 41 inches wide and 57 inches deep. There are 212 2-inch tubes in the boiler, 11 feet 6 inches long. There are 1,276.5 square feet of heating surface in the tubes and 98.9 in the firebox, making a total of 1,375.4. The grate area is 21.07. Tank capacity, 1,300 gallons. The following material is used: Consolidated safety valve, Nathan lubricator, Monitor injectors, Monitor headlights, American outside-equalized brake, Midvale tires, Consolidated valves, United States metallic packing, asbestos boiler covering.



DICKSON'S SADDLE TANK ENGINE.

To Change the Motive Power of Underground Railways.

A dispatch recently received from London says:

"Tenders for a contract to equip the old Metropolitan Underground Railway with electric traction will be opened on December 1st. The abandonment of steam on this line is due to the foulness of the tunnel, and it has been projected for a long time. It is estimated that the change will cost at least £5,000,000.

"Competition for the contract is confined to Great Britain, the United States, Germany and France. The American bidders are the Thomson-Houston and Westinghouse companies. The latter company is rushing work on its plant at Manchester, where it will employ 5,000 hands. It is establishing a plant at Rugby, where 3,000 hands are already at work. There are five English, four German and two French competitors.

"The company's engineer, Sir William Preece, says the bidders will not be hampered by specifications. He only wants the best system that can be obtained, providing for at least twenty-two trains an hour.

"A New York man is here conferring with the agent of Mr. Yerkes, the American railroad magnate, in the interest of the Americans behind the Hamstead Electric Underground Railway. He says the latter line will be in operation much sooner than the public expects. When it is going well other lines will be considered that can easily relieve the congestion in London 75 per cent., if the authorities will concede rights to surface lines. It is understood that experimental shafts have shown that Mr. Yerkes need not go anywhere lower than 75 feet, while the average depth of the line will be 45 feet.

Electricity and the Railroad.

Whenever a railroad man is frank enough to speak of the limitations of the present locomotive, the electrical enthusiasts immediately seize it as an admission that it is doomed. This to them means but one thing—that the electric motor is the only solution.

As a matter of fact it points to no such solution, as matters stand at present. Dynamos and motors now give about as high an efficiency as can be expected from machinery of any kind, and the loss in transmission is only a question of the amount that can be economically invested in conductors. There seems to be little likelihood of the steam engine and boiler being improved to such an extent as to materially decrease the cost of producing current; so that the question of cost still blocks the way.

Too many seem to forget that the electric motor is not a prime mover, but depends on the power behind the dynamo, just as much as a liquid air motor depends on the engine behind the compressor. And it seems reasonable to suppose that as long as the electric motor depends on the steam engine in nearly every case, the old locomotive has quite a lease of life left it still.

To Improve Sight and Hearing.

It is the intention of the officials of the Pennsylvania Railroad to endeavor to make the conditions on locomotives and locomotive cabs more conducive to the preservation of the sight and hearing of the men. It is a well-known fact that running an engine is very hard on the eyes of the engineer, and the work of firing requiring a man to keep his eyes riveted on the glaring, red-rot furnace, is very severe. In bad weather the engineer cannot see through the closed windows, and as his train rushes along through the air at a rate of 65 miles an hour he is pelted by the rain and sleet until his eyes and face are sore. The rumbling roar of the machinery, the piercing scream of the whistle and the rush of air to the ears are also very hard on these important organs. Good eyesight and hearing are indispensable to the engineer and to the fireman who expects promotion. Before the fireman learns to be a runner, his eyes and ears are liable to be defective. The alarming increase in eye and ear defects among railroad men has set the officials to thinking. They realize that it will be necessary before many years to have young and inexperienced men in charge of the trains or have deaf and blind men to do the work.

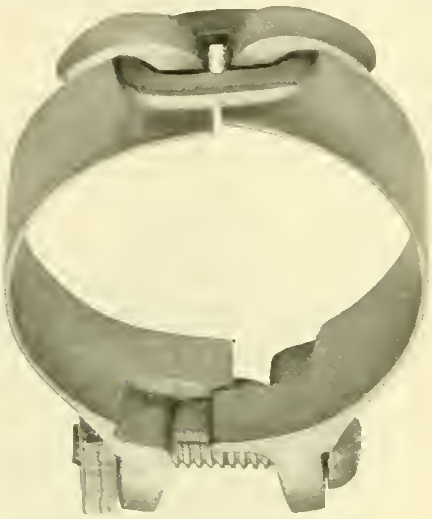
Recently the company has instructed Mr. R. Parks White, the special oculist and aurist, to take frequent trips over the road, riding in the locomotive cabs, to investigate the causes of defects in sight and hearing. He will study the conditions carefully and make such suggestions as his experience denotes to be consistent with the nature of the machinery and the work. —*Pittsburgh Post.*

We are continually receiving inquiries from people interested in passing examinations regarding the care of stationary engines, as to what information they must possess to pass the legal examination. The details of examination differ somewhat in different towns, but we believe that a fireman or other aspirant for an engineer's place who has studied Hemenway's "Catechism of the Steam Plant" thoroughly will pass in any city in the United States. The book, which is worth its weight in gold, is for sale in this office—price 50 cents.

The Bethlehem Steel Company have appointed Abner Doble Company, corner Fremont & Howard streets, San Francisco, Cal., their agents for the Pacific coast. They recently received an order from the Anaconda Copper Mining Company, of Anaconda, Mont., for a hollow-forged fluid-compressed steel shaft, 17 feet 10 inches long and 15¾ to 20 inches diameter, with a 7-inch axial hole, to replace a shaft which broke in the hoisting engine of the mine, necessitating a shut-down until the new one could be received. The new shaft was taken in hand under emergency conditions and finished, machined complete, within fourteen days from receipt of order, which was two days in advance of contract agreement. It weighed about 12,000 pounds, and, on account of the urgent nature of the case, was shipped to Anaconda by express in a special car.

Sectional Hose Clamp.

This is one of those handy little devices that are useful in so many places that the wonder is why we didn't think of it before. It needs no explanation, the cut does that, and any man with half an eye can see how the ears or lips are held together by the link while the clamp is tightened by the usual bolt. In patching burst hose of any kind it ought to be very



SECTIONAL HOSE CLAMP.

useful. It is the invention of our friend, Orange Pound, and is handled by E. T. Silvius & Co., Talbot Block, Indianapolis, Ind.

The Burlington, Alton, St. Paul & Pennsylvania roads are planning to enlarge the Union Station terminals in Chicago, at an expenditure of between $1,000,000 and $2,000,000.

The Burlington has secured another mail contract from the United States Government. The company puts on a second train to run to the North Pacific coast *via* Billings, Mont.

President Mellon, of the Northern Pacific, reports an agreement between his line, the Great Northern, and the Pacific Coast Company for the construction of suitable terminals at Seattle.

The Boston & Maine announces that arrangements have been effected with the Scandinavian-American Steamship line for regular sailings from Boston to Copenhagen, beginning November 20th. Four vessels are to be employed.

Installation of the International Correspondence Schools' Air-Brake Instruction Room at Chicago.

The opening of the air-brake and general instruction room at Chicago, and the following convention of prominent air-brake men from different parts of the country, was successfully performed Tuesday evening, November 20th. The plan of Manager A. M. Mitchell to invite prominent air-brake men to lecture at the opening proved to be a good one.

The installation of a permanent air-brake instruction room is a new departure from the policy of the International Correspondence Schools, as they have heretofore transacted their work through the medium of thoroughly equipped instruction cars, which they keep constantly moving on the roads throughout the country. The unusually large number of students of the schools in Chicago, however, warrants the opening of a school of this kind in that city, as there are enough men there to keep the room busy, which they will undoubtedly do.

The schoolroom was formally opened Tuesday evening at 7:30 P. M., by Mr. C. B. Conger, who gave a short history of the International Correspondence Schools. He began with the inception of the school, when it was but a small mining school, and followed its growth up to the present time, where, after two and a half years' existence, the railroad department alone has over 22,000 students. He was followed by Mr. S. J. Kidder, of the Westinghouse Air-Brake Company, who delivered an interesting lecture on the history and development of the air-brake. He began with the earlier forms of chain brakes, spring brakes and straight air-brakes, finally ending with the quick-action automatic and high-speed brake. Mr. Kidder's talk was very interesting and instructive, including a detailed history of the battle of the brakes at Burlington, Iowa, in 1887, and the final triumph of the Westinghouse compressed air-brake.

Mr. Carleton, air-brake instructor for the Chicago & Northwestern road, followed Mr. Kidder and dwelt particularly on that side of the brake question pertaining to operation and maintenance. Mr. George Parker, of the Iowa Central Railroad, and Mr. Kershaw, of the Chicago, Milwaukee & St. Paul Railroad, also spoke to the convention.

After these speakers had finished, Mr. Conger and others worked the train of six high-speed brakes for the men present and gave an excellent exhibition of the operation of this highly efficient and powerful device. The evening's performance closed with a general discussion of air-brake matters in a rather unconventional manner.

Wednesday's session opened up about 10 o'clock. Mr. F. B. Farmer, of the Westinghouse Air-Brake Company, delivered a very interesting and instructive lecture on the operation of heavy freight trains on steep mountain grades. Mr. Farmer's lecture was replete with many valuable suggestions and experiences on modern freight-train practice. He was followed by Mr. W. H. Foster, one of the able instructors of the schools, who, with the aid of stereopticon views, gave a characteristic lecture of instruction on the air-brake.

In the afternoon Mr. S. D. Hutchins spoke in eulogistic terms of the schools, their aims and successful management, following at considerable length with the subject of equalizing discharge valves.

In the evening Mr. R. H. Blackall lectured on the handling of long freight trains on level roads. Mr. Blackall's lecture, like Mr. Farmer's, was excellent in its practical hints and experiences, and elucidated the most modern and successful practice of long freight train handling on level Eastern roads. Then followed a general discussion of air-brake subjects. Among the principal subjects were those of quantity and quality of oil that should be used in air cylinders of air pumps and the proper kind of gaskets for train-pipe connections at the triple valve. Mr. Hutchinson, Mr. Cass, Mr. Blackall, Mr. Kidder, Mr. Carleton, Mr. Houchin, Mr. Parker and other prominent air-brake men took active part in the discussion.

The evening's performance ended with an informal discussion and a general operation of the 60-car train of freight brakes and the 6-car train of high-speed brakes.

Thursday was given over more to general discussion and operation of the equipment in the room. Messrs. Foster and Beckwith, of the Correspondence Schools' staff of instructors, gave lectures and stereopticon views at intervals during the day. The stereopticon feature of the schools' instruction is certainly a valuable one and will, ere long, doubtless be adopted by railroads in their air-brake instruction courses.

In the evening, Mr. F. M. Nellis, of Locomotive Engineering and the Westinghouse Air-Brake Company, gave a brief dissertation on the development and maintenance of air-brakes. He was followed by Mr. Carleton, of the Northwestern road, who spoke interestingly at some length on the high-speed brake and its splendid performances. Mr. Hutchins and others added discussion to the subject.

At 9.30, Manager Mitchell invited those present to a banquet which he prepared and had spread in one of the schools' large office rooms upstairs. The spread was sumptuous and toothsome; and the avidity with which the delicacies were attacked by the guests proved that they could do something else beside talk air brakes. Manager Mitchell proved an able and graceful toastmaster on the occasion, and Messrs. Kidder, Carleton, Paterson and others eloquently toasted the schools and their able management.

Thus ended the successful installation of the best equipped and most elaborate air-brake instruction room in the country. The many words of praise bestowed upon the room, its designers and managers are all due, and the railroad men in and around Chicago are lucky to have such a place at their disposal.

North-West Railway Club.

The regular monthly meeting of the North-West Railway Club was held in the parlors of the Ryan Hotel, St. Paul, Wednesday evening, November 14, 1900.

Mr. C. C. Jett, instructor in mechanical engineering at University of Minnesota, presented an illustrated paper on "The Use of the Stereopticon in Teaching Railway Signaling."

The discussion on "The Wear of Driving-Wheel Tire," which was continued from last meeting, was concluded at this meeting. Discussion was also held on Mr. Zachritz' paper, presented at the October meeting, on "Repairs to Private Line Cars," and "The Utilization of Air-Pump Exhaust for Heating Feed Water on Locomotives."

The Richmond Locomotive Works have just received an order from the Rio Grande Western Railway for five $23\frac{1}{2}$ inch and 30 by 28 inch compound consolidation locomotives, the principal dimensions of which are as follows: Drivers, 56 inches in diameter; total weight, 187,000 pounds; weight on drivers, 170,000 pounds; firebox, 122 by 41 inches; total wheel base, 24 feet 6 inches; driving-wheel base, 16 feet 3 inches; tires, $3\frac{1}{2}$ inches thick; driving axle journals, 9 by 12 inches; steam pressure, 185 pounds; 6,000-gallon tender.

Mr. J. B. Kingan, recently connected with the Chicago, Rock Island & Pacific Railway as traveling engineer, has resigned to engage with the International Correspondence Schools, of Scranton, Pa., as instructor and lecturer on the locomotive and air brake. Mr. Kingan has been in service in the locomotive department since 1872, having served apprenticeship as a machinist, at which trade he served about sixteen years. He also served as fireman and engineer, traveling engineer, and roundhouse foreman, which experience certainly fits him for the work to which he is now assigned, and in an opinion to say that his efforts will be successful is a matter of foregone conclusion.

As a freight train was nearing Kaysville, Utah, on the Oregon Short Line, the platform steps at one side of the caboose were knocked off in striking a cow. The defect was not noticed by a brakeman, who stepped out to signal the engineer, and he fell through unhurt. Another brakeman followed, and, falling with one arm across the track, had it cut off. The conductor ultimately followed the two brakemen, but escaped unhurt.

A New Style Grinder.

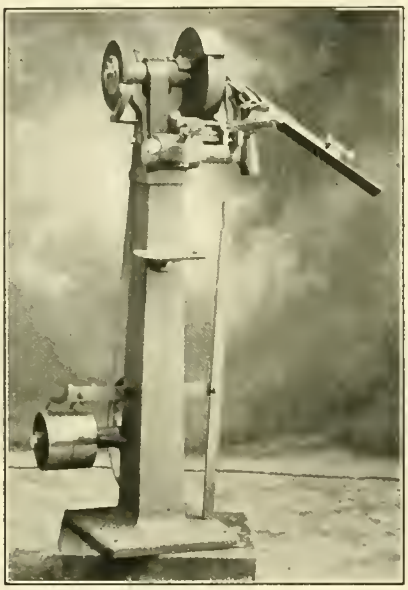
Anyone who has had experience grinding a twist drill by hand knows what an interesting task it is and that the chances of its cutting to size afterwards are remarkably slim.

A drill grinder that will do this work as it should be done is a necessity in any shop, and the new grinder just brought out by L. S. Heald & Son, of Barre, Mass., has points of merit which will interest mechanics generally.

This is their latest machine, and has the improvement of placing the belt in the center between two taper bearings for the wheel arbor or shaft. This allows perfect take-up for all wear—a necessity for the best results in drill grinding. A ring wheel is used, giving excellent results.

Then there is a safety chuck for the drills, and the opening for the fingers of the operator near the upper end of holder makes it easy to grind small drills.

There is a safety stop which saves money by preventing drills being ground wrong, and the design prevents small drills from falling down out of reach in this drill holder—saves using a stick to poke them out with. As there are only two adjustments necessary to get exactly the right setting for any diameter drill, it is not necessary to have the machine operated by a skilled mechnic.



NEW AMERICAN TWIST DRILL GRINDER.

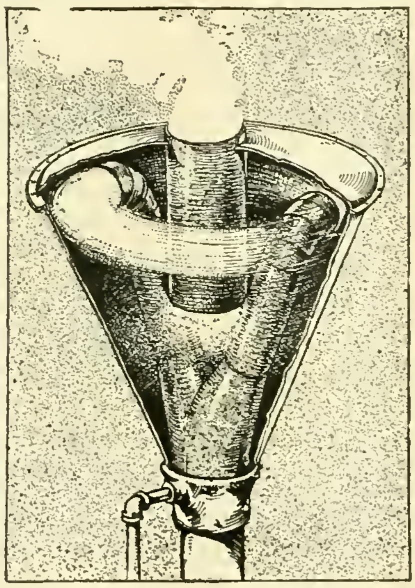
In describing the New York Central's latest express engine on page 461 of the November issue, the tractive power was given as 12,000 pounds, instead of 19,128 pounds, and the ratio of traction to adhesion as 8, instead of 4.8.

The joint committee of the Master Car Builders' and Master Mechanics' Associations will meet at the Iroquois Hotel, Buffalo on December 11th to determine on the date and place of next convention.

The Operation of the Sturtevant Exhaust Head.

An interesting example of the practical application of centrifugal force is presented in the design of the Sturtevant Exhaust Head. The accompanying illustration serves not only to show its construction but also its method of operation.

Externally it appears to be an inverted cone of heavy galvanized steel plate attached to the end of the exhaust pipe. Its interior construction is shown to consist of two branching pipes extending upward from and connected to the exhaust pipe. These individual pipes which are parallel to the sides of the casing terminate in elbows from which the steam escapes. Its contact with the circular sides ot the case gives it a whirling motion, which thus gives centrifugal force an opportunity to act. Inasmuch as this force is proportional to the weight of the substance acted upon, and as water weighs about 1,600 times as much as does exhaust steam, the natural result is that the water contained in the steam is thrown outward in radial lines with great force. Striking upon the sides of the cone, it trickles to the bottom, and there escapes through the drip pipe. Such oil as may be entrained with the steam is likewise separated.



STURTEVANT EXHAUST HEAD.

The steam, now dry, is forced downward by the additional entering volumes and quietly escapes to the atmosphere through the central pipe. It is evident that all tendency on the part of the water to scape with the steam is most forcibly overcome by the centrifugal action.

The central pipe being made larger than the supply beneath, and the cold sides of the case tending to condense a portion of the steam, it is manifest that no back pressure can be exerted upon the engine. The absence of baffle plates and the absolute simplicity of design are the best guarantees of endurance on the part of this head.

It is built by the B. F. Sturtevant Company, of Boston, Mass., in sizes ranging from 1 inch up to 36 inches size of exhaust pipe.

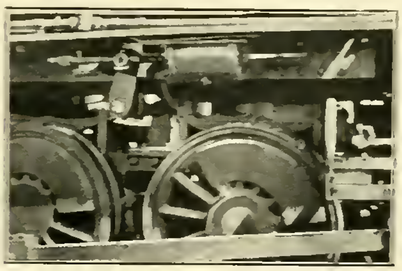
This company has just received an order for two immense exhaust heads, one for a 30-inch pipe and one for a 36-inch pipe, which are to be built on this design.

Power Reversing Gear.

I noticed an article in the October number of LOCOMOTIVE ENGINEERING by Mr. John W. Troy about the non-existence of an automatic reverser for large engines.

I beg to say that there is an air reverser used on the Mexican Central Railway at this place that was devised by Master Mechanic W. Cockfield and General Foreman Thos. Smith, and has been giving perfect satisfaction for two years. I enclose photo of cylindrical attachment on arm of tumbling shaft.

A common 8-inch freight-car cylinder is used, with a double head, and a two leather piston. It is controlled by a common ½-inch stop-cock, bushed down to ¼ inch, and a new plug is made and drilled into a four-way valve. The valve is quite complicated, and, as it is not patented, I think Mr. Cockfield or Mr.



POWER REVERSING GEAR.

Smith would cheerfully furnish further information.

When the handle (or lever) is thrown ahead, it allows the air to exhaust out of front end of cylinder, and at the same time to open port, and take air at back end of cylinder, which throws the driving lever ahead and when thrown back *vice versa*. When put on center, it allows air in both ends of cylinder and locks the reverse lever.

Enough air can be admitted in either end of cylinder which allows the engineer to throw reverse lever by hand and hook same up whenever wanted. It is very quick of action and makes the work of the engineer much easier.

This reverser has had a hard test and has proved itself in many hard trials. It is easily, cheaply and quickly made.

Old Mexico is not so very far behind the times. WALTER E. ROCK.

San Luis Potosi, Mexico.

For some time past, certain hostile newspapers and political forces in New York City have been decrying the supposed weakness of the elevated structure of the Manhattan road. A recent occurence of importance, however, will doubtless silence these howls for a time at least. At the time of the great Warren street fire, when the Tarrant building was blown to pieces by burning explosive chemicals, a great many tons of iron, stone and debris fell upon the structure of the Ninth Avenue Elevated, doing no damage except to injure one span between pillars. This surprising fact seems to indicate that the structure is strong enough for safety and to stop the noise being made by these vicious forces.

"Atlantic Type Locomotives" is the title of No. 20 of the Baldwin Locomotive Works "Records of Recent Construction." It is a particularly attractive number, containing 84 pages, and gives much valuable data as to the performance of this class of engines on various roads. It is printed in both French and English.

A line may be had on the prosperous condition of the Pennsylvania lines east of Pittsburgh by comparing the recent coal shipments on that line with those of a year ago. For the year ending November 3d, 26,241,069 tons were shipped against 23,144,940 tons last year, a difference of 3,096,129 tons in favor of this year.

The Cooke Locomotive & Machine Company, of Paterson, N. J., have just completed the shipment of eighteen 20 x 24-inch eight-wheel passenger locomotives for the Southern Pacific. They are also finishing an order for some very heavy consolidation engines.

The repair shops Baring Cross, Ark., belonging to the Iron Mountain Railroad, were destroyed by fire last month. Four hundred men were thrown out of employment, and their personal loss for tools was very great. The loss to the company is about $250,000. New shops will be built immediately.

The American Turret Lathe Company, of Wilmington, Del., have issued a neat pamphlet entitled, "Three Points of View." It illustrates their Semi-Automatic Turret Lathe and tells of its good points. Those who are interested in reducing the cost of their lathe work should send for a copy at once.

Professor Goss, of Purdue University, Lafayette, Ind., writes us: "You will be interested in knowing that among our new students are several full-fledged engineers who, having secured leave from the roads with which they have worked, are making good progress in the work required for the regular degree.

Boston & Albany Remains Practically Unchanged.

It is said in financial circles that Vice-President Hayden will direct the officers of the Boston & Albany, so far as the organization is concerned. The physical condition of the property will not be changed in any way by the lease of the New York Central. The lettering on the equipment will remain as formerly.

A colored plate, 8 x 10 inches, of the 9½-inch air pump is sent with each copy of the Railway Department circular issued by the International Correspondence Schools, Box 801, Scranton, Pa. The circular describes the schools' special courses for railroad men, and will be sent free.

The Tabor Manufacturing Company, builders of the well-known vibrator and vibrator frame molding machines, announce their removal from Elizabeth, N. J., to their new shop, southeast corner Eighteenth and Hamilton streets, Philadelphia, Pa.

An elaborate catalogue has been received from the Dobbie Foundry & Machine Company, Niagara Falls, N. Y., telling of their "Niagara" shaking grate. It contains much valuable information in steam and electrical lines.

A Washington (D. C.) press report quotes Manager St. John, of the Seaboard Air Line, as follows: "In my forthcoming report I shall be able to say that during the past year we have placed along our line 900 new industries and located there some 9,000 additional residents."

The Mason Regulator Company, of Boston, have favored us with copies of their catalogues, which cover their governor, pumps, reducing valves, air pump regulator and other specialties. They are nicely gotten up and contain much information of value.

Volume 2 of "Cambria Steel Rails" has just been issued by the Cambria Steel Company, Philadelphia, Pa. It not only shows rails, but rail-guards, splice bars and frog fillers. Dimensions are given in every case, making it valuable for reference.

The Chicago & Northwestern is planning to build a third track between Chicago and Omaha, the second track now being finished from Chicago to Nevada, Iowa, 317 miles.

It seems a difficult thing to do, and it is, for a n an to decide to buy brake shoes that "wear out quickly" rather than those which "will outlast two of any other manufacture." A brake shoe that "never wears out" is on a par with a dinner that won't digest.

The Philadelphia Car Service Association shows in its October statement that it handled during the month of October 122,338 cars, and the total average detention was 1.33 days. Of this number, 114,001 cars were detained under 48 hours, and 8,337 over 48 hours.

Denver papers say that a rumor is current to the effect that the Illinois Central and Rock Island roads are arranging a connection from Denver to the Pacific Coast. It is supposed that Senator Clark's Los Angeles line has something to do with the scheme.

The Richmond Locomotive Works have received orders for six locomotive boilers from the Central Vermont and one locomotive boiler from the Cincinnati Northern. The Richmond Locomotive Works are working into a good business in boiler-making in addition to their regular locomotive work.

Washington (Pa.) reports state that the Panhandle road has started work on extensive improvements at that place and that the Pennsylvania Company will, within ninety days, begin the building of a broad-gage road to Waynesburg.

The 300 bridges on the Pennsylvania division of the New York Central will shortly be replaced by new structures of recent pattern.

Reports from Victoria, B. C., intimate that President Hill, of the Great Northern, is negotiating to have his road extended to the west coast of Vancouver Island.

The heavy initial reduction at high speed, followed by a release and lighter final reduction approaching end of stop, will greatly reduce slid-flat wheels.

The Bethlehem Steel Company have again opened a St. Louis office, at 930 North Main street, where they will be represented by Mr. S. E. Freeman.

President Mellon, of the Northern Pacific, announces that he has been authorized to expend about $300,000 for terminals in Portland, Ore.

The Pennsylvania Railroad has awarded a contract for the building of seven steel, double-tracked bridges on the low grade division of the Allegheny Valley.

The American Brake Company have sent us one of their late catalogues of locomotive driver and truck brakes.

The Fox Lake extension of the Chicago, Milwaukee & St. Paul has been opened, an additional six miles having been completed.